43

PREDICTION OF COLLEGE PERFORMANCE

THE RELATION OF GENERAL AND SPECIFIC COLLEGE ACHIEVEMENT TO PREVIOUS ACADEMIC PERFORMANCE, "INTELLIGENCE" SCORES, AND SUBJECT CONTENT TESTS

By

MAZIE EARLE WAGNER

Submitted in partial fulfillment of the requirements for the degree of doctor of philosophy in the faculty of philosophy, Columbia University.

THE UNIVERSITY OF BUFFALO STUDIES

VOL. IX

BUFFALO, N. Y.

MAY 1934

ACKNOWLEDGEMENTS

The present research is part of a larger investigation being carried on by the Study of the Superior Student under the auspices of the University of Buffalo. It was made possible through a grant from the General Education Board. The present study appears also as Part II of "Studies in Articulation of High School and College", THE UNIVERSITY OF BUFFALO STUDIES, *Vol. 9. To the editor of this larger volume, Professor E. S. Jones, the author is indebted for gracious permission to reprint separately, as well as for the original suggestion of the specific prediction problem.*

To Professor A. T. Poffenberger, the author is very grateful for continued patience, encouragement, and direction during the difficult period of dissertation-preparation.

To Dr. H. J. P. Schubert is due gratitude for criticism of the manuscript and for encouragement during its preparation.

Without the unfailingly conscientious and accurate statistical work of Eunice Strabel, the research would have been utterly impossible.

TABLE OF CONTENTS

CHAPTER I. INTRODUCTION 1
- I STUDENT BODY 1
- II DATA COLLECTED 2

CHAPTER II. PREDICTION OF AVERAGE COLLEGE MARKS 4
- I FOR TOTAL GROUP INVESTIGATED 4
  - 1. By Regents Marks and Test Scores 4
  - 2. By High School Fifth 10
  - 3. By Combinations of Various Measures 13
  - 4. By Regents Average in School Groups 14
- II FOR SELECTED SCHOOL GROUPS 15
  - 1. By Senior Year Regents Average, Total and Senior Year School Averages, and Rank in Graduating Class 15
  - 2. By Combining Regents Average and Rank in Class 17
- III AS MEASURED BY SOPHOMORE "OBJECTIVE" TEST RESULTS 18
- IV SUMMARY AND IMPLICATIONS 19

CHAPTER III. PREDICTION OF SPECIFIC COLLEGE FIELD AND COURSE PERFORMANCE 21
- I IN ENGLISH 21
  - 1. Using Regents Examination Marks, School Averages, Pre-Freshman Test Performance, and the Like 21
  - 2. Using the Cooperative English Test 24
  - 3. Using the Nelson-Denny Reading Test 26
  - 4. Using a Combination of Measures 26
  - 5. As Measured by the Sophomore "Objective" Test Results 27
  - 6. Summary 28
- II IN MATHEMATICS 30
- III IN THE MODERN FOREIGN LANGUAGES 32
- IV IN THE SOCIAL SCIENCES 37
  - 1. Average College Social Science 37
  - 2. The Social Science Orientation Course 38
  - 3. History in College 39
  - 4. Economics and Government 40
  - 5. Psychology and Sociology 43
  - 6. Summary 44
- V IN THE PHYSICAL SCIENCES 45
  - 1. Average College Physical Science 45
  - 2. The Physical Science Orientation Course 45
  - 3. Physics 45
  - 4. Chemistry 47
  - 5. Biology 48
  - 6. Geology 48
  - 7. Summary 48

CHAPTER IV. GENERALIZATIONS REGARDING PREDICTION AT THE UNIVERSITY OF BUFFALO WITH BROADER IMPLICATIONS .. 50

CHAPTER V. A SURVEY OF THE LITERATURE ON COLLEGE PERFORMANCE PREDICTION 59
I THE HIGH SCHOOL AVERAGE 59
II INTELLIGENCE TESTS 61
III CONTENT EXAMINATIONS AND BATTERIES OF PLACEMENT TESTS 63
IV MULTIPLE CORRELATION COEFFICIENTS 63
V SPECIFIC FIELD PREDICTION 65
VI PREDICTING COLLEGE ENGLISH SUCCESS 65
VII PREDICTING COLLEGE MATHEMATICS 66
VIII PREDICTING COLLEGE LANGUAGE PERFORMANCE 66
IX PREDICTING COLLEGE SOCIAL SCIENCE 67
X PREDICTING COLLEGE PHYSICAL SCIENCE 68
XI SUMMARY 68

BIBLIOGRAPHY 70

APPENDIX 75

CHAPTER I

INTRODUCTION

ALMOST every college has within its archives a study or two[1], and some many more, devoted to the prediction of college success. There are literally hundreds of publications each year reporting relationships between a general college average or individual college subjects and all manner of criteria. A wide variety of betting systems, to use Dr. Brigham's apt phrase[2], are being examined, criticised, remade, and re-examined. Items found in some of the most widely used betting systems, or prediction formulae, are (1) graduation from accredited preparatory and public high schools, (2) excellence of high school grades, (3) personality ratings, (4) College Entrance Board Examinations, (5) scholastic aptitude and psychological tests, and (6) objective content examination scores. The scholastic aptitude or psychological examination, an outgrowth of the testing of the World War army drafts in this country, has had a mushroom development. Hailed as an easy solution of the prediction problem, tests, more or less patterned after the Army Alpha, have been devised in large numbers and have been used wholesalely. The content examinations are a more recent development of the objective test movement. Most colleges and universities today are using a combination of measures, are becoming more conservative in their interpretations of tests, and are again looking particularly to previous performance, as indication of ability and motivation, and as such, as predictors of future performance.

At the University of Buffalo, studies of this kind have been made from time to time[3]. The present study is a more thorough and exhaustive investigation of prediction of success and failure at this University than has been heretofore possible.

I. STUDENT BODY

The main portion of our investigation uses for subjects all those students who entered the University of Buffalo as freshmen during the years 1925 through 1929 (661 men and women), except those transferring to another college before finishing two years in this institution and those "failed out" before finishing one semester of college work. For some major relationships, we have added the class entering in 1930, increasing our total number to 806. The classes entering in 1931 and 1932 have been more intensively studied for the relationship of placement test results to subsequent college class grades.

---

[1] See Chapter V.

[2] Brigham, C. C., "Admission Units and Freshman Placement," *Educational Measurement and Guidance*. Report of the Second Conference under the auspices of the Cooperative Test Service and the Committee on Personnel Methods of the American Council on Education and the Educational Records Bureau, New York, November 2-3, 1933. American Council on Education, 744 Jackson Pl., Washington, D. C.

[3] Jones, E. S., "Training the Inferior and Doubtful Freshman," *Personnel Journal*, 1927, 6, 182-91.
———"Prediction from High School Performances," *School and Society*, 1928, 27, 339-40.
———"Studies from the Office of Personnel Research," *The University of Buffalo Studies*, 1930, 8, 1-87.

II. DATA COLLECTED

The following factual materials were gathered:

The two-year college average: a weighted average of all letter grades received, where A=6, B=5, C=4, D=3, E=2, and F=1. The highest possible average would be an all A record, or 6; the lowest, a "complete bust", or 1. No student among our cases reached either extreme. This item of information was obtainable for every student in this study.

The high school Regents average: a weighted average of all "academic" New York State high school Regents grades reported by the high school to the college. Grades in music, drawing, shop, home-making, and commercial subjects were deleted from the average, not being considered "academic". Each Regents grade was weighted according to the amount of unit credit which is represented. (A few of the freshmen at this University come from private schools and schools outside the state which do not give Regents Examinations. These, together with those presenting less than twelve units of "academic" credit, were marked as having "no record" on the high school Regents average classification.)

College subject averages were calculated in English, mathematics, language, social science, and physical science in the same manner as the total college average described above.

All *individual college course grades* were secured.

All *high school individual subject Regents grades* were also obtained. In addition the school marks for four years of English were averaged to give a school English average. This was done for as many years of Latin, French, German, and Spanish as the individual student submitted, so that there is available also a school Latin average, and school modern foreign language averages for such students as carried these subjects in the high schools.

The *American Council Psychological Examination for High School Graduates and College Freshmen*[4] had been given each year to entering freshmen. Previously determined centile scores were converted into standard or sigma scores[5] for both the entire Psychological Examination and for the five sub-tests used in the later forms: Completion, Artificial Language, Arithmetic, Analogies, and Opposites.

---

[4] Prepared by L. L. Thurstone and Thelma Gwinn Thurstone; published by the American Council on Education, 744 Jackson Place, Washington, D. C. Much of the statistizing done for this test was performed by Mary E. Sarbaugh.

[5] Hull, C. L., "The Computation of Pearson's r from Ranked Data," *Journal of Applied Psychology*, 6, 1922, 385-390.

The *Iowa High School Content Examination*[6] had been given to four of the five entering classes under consideration. Sigma scores for the total Iowa Content Examination and for the four sub-tests, English, Mathematics, Social Science, and Physical Science, were also entered for each student.

In order to test the relative predictive value of *place in high school* graduating class, as contrasted with Regents average, the exact position in the class was collected for all students from four of the large high schools of Buffalo. These ranks were converted into sigma scores[7].

For students attending the large Buffalo high schools, the *particular school* was indicated. An attempt was made to classify the smaller high schools as located within (1) residential suburbs of Buffalo, (2) industrial suburbs of Buffalo, (3) cities, such as Rochester and Niagara Falls, N. Y., and (4) rural villages.

In addition the following *miscellaneous* information was obtained for each student: age at high school graduation, the fifth of his high school class in which the student was placed on the basis of average classroom grades, sex, number of high school units at college entrance, year of college entrance, degree sought, amount of foreign language spoken in the home, father's occupation, together with rank in and size of family. No statistical relations regarding the four last mentioned items are herein included.

All the above described data were entered on Hollerith cards by the usual Hollerith punch-card equipment, and statistical relationships made by hand sorts. The punched Hollerith cards permitted checking of the sorts which otherwise would have been very difficult.

---

[6] Devised by G. M. Ruch, G. D. Stoddard, and others. Published by the Bureau of Educational Research and Service, University of Iowa, Iowa City, Iowa.

[7] Hull, Clark L. *Op. cit.*

CHAPTER II

THE PREDICTION OF AVERAGE COLLEGE MARKS

I. FOR TOTAL GROUP INVESTIGATED

The most important task in any college prediction study is the preliminary classification of freshman applicants. Such classification should lead to the early elimination of those who would fail in any field of college endeavor and the selection of those who would succeed regardless of classes and courses. Second should come direction into such particular fields of activity as lend themselves to the pecularities of the individual's training, ability, and temperament together with an approximation of his success in such fields. The two-year college average was selected as an index of general success or failure in college work; and our first statistical relationships were directed toward its prediction. Subsequently, we considered prediction in special fields.

Regents Marks and Test Scores

As a first step in our study of the two-year college average, relationships were established between this criterion and various measures obtainable at or prior to college entrance by means of the Pearsonian correlation coefficient[8]. The various measures studied are listed in Table I, in the order of the size of the coefficient of correlation[9] for the total group of both men and

---

[8] The Pearsonian correlation coefficient (*r*) is a means of expressing in a single figure the closeness of relationship between two variables, without attempting to say whether the first causes the second, or the second causes the first, or some underlying factor causes both. When *r* equals 1.00, the relationship is perfect, one to one, the individual who is most extreme on measure A being also most extreme on measure B, the second on A being likewise second on B, and so on. Coefficients approximating 1.00 are very rarely found in educational research. Coefficients over .80 show that a high relationship exists between the two measures. In educational statistics, relationships as high as this are but infrequently found. Coefficients of correlation of from .60 to .80 are considered of value as indicating relationship, and appear in prediction work occasionally; *r's* from .40 to .60 are frequently found, and indicate some relationship; *r's* below .40 are practically valueless for individual case prediction, though they do show gross tendencies. Negative *r's* indicate that the relationship is negative, that the highest on one measure tends to be lowest on the second, and so on. For further elaboration of the concept and use of the correlation coefficient, see any text on educational statistics.

Separate correlation coefficients were calculated for boys, girls, and combined boys and girls. This permitted a very helpful check on these figures in that, subsequent to the completion of such calculations, by using the same guessed average for the three groups considered, the sum of sub-totals and intermediate step calculations for the boys and the girls could be found to equal the total. In this manner, any error would be quickly found.

[9] It is to be noted that all correlations in this study are lowered by the following factors: (1) all those at the bottom end of the distribution in the high schools are eliminated from the distribution, since no high school failure is permitted to enter college; (2) the fact that we did not consider in our two-year college average, and so eliminated from the study, all who did not complete at least one term of college work, that is, all at the extremely negative end of the college distribution; (3) the use of a two-year college average rather than a freshman average or a first semester average. With the addition of each year of work, factors such as greater acquaintance between student and faculty, motivating and emotional changes within the student, and the like delete the correspondence between high school and college grades. See Thorndike, E. L., *Science*, 1906, *23*, 842. (4) Whenever a Regents examination had been repeated, only the final grade received is sent to the college. This omission of first Regents grades made may well reduce correspondence. See Sarbaugh, M. E., "Articulation of High School and

Table I

ZERO-ORDER CORRELATIONS* BETWEEN FRESHMAN AND SOPHOMORE COLLEGE AVERAGE AND REGENTS MARKS, SCHOOL GRADES, AND TEST SCORES

		BOYS		GIRLS		TOTAL	
		No.	r	No.	r	No.	r
1	H. S. French Ave.	138	.57	128	.66	266	.65
2	Total Regents Ave.	392	.61	217	.73	609	.64
3	H. S. German Ave.	53	.55	20	.91	73	.62
4	Reg. French IV	8		16		24	.61
5	Reg. Latin III	251	.56	156	.61	407	.58
6	Reg. Latin IV	32	.60	67	.59	99	.57
7	Reg. French III	100	.58	99	.53	199	.56
8	Reg. German III	37	.44	19		56	.56
9	H. S. Latin Ave.	259	.48	149	.62	408	.56
10	Reg. French II	214	.43	171	.63	385	.55
11	H. S. French I	207	.50	161	.52	368	.54
12	H. S. English Ave.	337	.40	183	.57	520	.53
13	H. S. German I	63	.37	25	.77	88	.52
14	H. S. Italian	13		5		18	.50
15	Reg. Latin II	366	.46	204	.51	570	.50
16	Total Iowa Content	347	.48	140	.57	487	.49
17	Iowa Content History	346	.42	140	.59	486	.49
18	Reg. Trigonometry	85	.45	19		104	.48
19	Reg. Economics	73	.35	16		89	.48
20	Reg. Eng. Lit.	54	.42	54	.45	108	.47
21	Reg. Chemistry	146	.53	48	.24	194	.47
22	H. S. Latin I	348	.40	186	.68	534	.47
23	Iowa Cont. Phys. Sci.	346	.33	140	.33	486	.46
24	Reg. Amer. History	397	.38	209	.43	606	.46
25	Reg. Eng. IV	432	.37	236	.55	668	.46
26	Iowa Cont. English	347	.46	140	.48	487	.46
27	Reg. German II	66	.34	26	.54	92	.44
28	Reg. Eng. II	418	.34	223	.48	641	.42
29	Reg. Anc. History	387	.35	200	.51	587	.42
30	H. S. English I	387	.34	198	.48	590	.42
31	Reg. Elem. Biology	376	.36	198	.49	574	.41
32	Reg. Eng. History	63	.38	4		67	.41
33	H. S. Music	65	.25	67	.42	132	.40
34	Reg. Physics	258	.41	70	.44	328	.40
35	A. C. E. Opposites	430	.42	229	.33	659	.38
36	Reg. Eng. III	453	.27	231	.44	664	.37
37	Reg. Solid Geom.	66	.32	10		76	.36
38	Reg. Int. Alg.	416	.34	216	.31	632	.35
39	Reg. Med. & Mod. Hist.	69	.27	38	.53	107	.33
40	A. C. E. Total	417	.27	227	.38	644	.33
41	H. S. Civics	422	.28	217	.38	639	.31
42	A. C. E. Completion	430	.31	229	.39	659	.29
43	Reg. Plane Geom.	430	.26	227	.30	657	.28
44	Reg. Eng. Grammar	268	.30	162	.18	430	.28
45	Reg. Econ. Geog.	17		9		26	.27
46	Reg. Phys. Geog.	46	.20	37	.44	83	.27
47	A. C. E. Art Lang.	430	.13	229	.28	659	.25
48	Reg. Elem. Alg.	438	.17	231	.35	669	.24
49	A. C. E. Analogies	366	.24	145	.23	511	.23
50	Age at H. S. Grad.	423	−.21	217	−.22	640	−.22
51	Reg. Bookkeeping	19		9		28	.21
52	Reg. Adv. Alg.	65	.09	16		81	.21
53	Iowa Cont. Math.	346	.25	140	.20	486	.20
54	A. C. E. Arith.	430	.07	229	.30	659	.15
55	Reg. Mech. Drawing	63	.08	7		70	.08
56	Reg. Elem. Repres.	116	.02	76	.13	192	.05
57	Reg. Comm'l Arith.	31	−.11	17		46	−.04

---

* Correlations listed according to size of *r* for the combined group of boys and girls. See Garrett, H. E., *Statistics in Psychology and Education.* Longmans, Green and Company, New York. 1926, p. 171, for table of probable errors of correlation coefficients.

women. The coefficients for either men or women, both of which are given, would somewhat disturb this order, although not radically.

The first item of interest in our first table is the relationship between the Regents average[10] and the two-year college average, represented by a correlation coefficient of r.61 for the boys, r.73 for the girls, and r.64 for the total group. This is higher than for any other measure except the high school French average for the total group, and the difference is very slight.

The second item of interest in Table I is the amazingly high college-average prediction value of all the high school Regents language grades as well as of the school average grades in languages. It will be noted that high school average French and high school average German[11] give correlation coefficients for the total group respectively .01 higher and .02 lower than the Regents average—well within the probable error of these coefficients. Regents French IV stands next, but only twenty-four students submitted credit in this subject, which fact eliminates this subject from those of value in guidance.

All the remaining Regents foreign language scores and high school foreign language averages give correlation coefficients with the two-year college average between r.58 (Regents Latin III) and r.50 (Regents Latin II), the order being: Regents Latin III, Regents Latin IV, Regents French III, Regents German III, high school Latin average, Regents French II, high school French I, high school German I, high school Italian I, and Regents Latin II. That is to say, the languages, ancient and modern, head the list in prediction value, taking positions number one through fifteen, except for the high school Regents average taking second place, and high school English average the twelfth.

The total Iowa Content Examination and the Iowa Content History subtest tie for the sixteenth place in the series; that is, these two measures predict better than all other criteria examined except the total Regents average, the languages, and high school English average.

Taking a middle position in the ranking of items studied, there is an assortment of various subjects made up of trigonometry, the various English, the physical science, and the social science Regents grades[12].

College," *The University of Buffalo Studies*, 1934, IX, 174-183, for a discussion of this factor. Finally, (5) the narrow range of ability of our college entrants is a self-selective factor operating within the groups of high school graduates in our environment. Of the 393 boys for whom we have a high school fifth rating, twenty-five per cent are in the top fifth, thirty-three in the second, twenty-seven in the third, and only eight per cent in the fourth, and six per cent in the fifth fifth. That is to say, eighty-six per cent of our boys are in the top three fifths of their high school graduating classes. The girls are even more highly selected for ability in high school. Of the 209 girls for whom we have this item of information, forty-five per cent are in the first fifth, thirty-three in the second, fifteen in the third, four in the fourth, and three in the fifth fifth. Seventy-eight per cent of our girls are in the top two fifths of their graduating classes.

[10] See Chapter V for a discussion of the relation between college success and both high school average and Regents Examination averages in other colleges.

[11] These high school averages are the average of all school grades made in the subject. They are school marks, not Regents marks.

[12] Refer to Table I for the exact order.

The American Council Psychological Examination[13] total and sub-tests, Regents English grammar, mathematics Regents[14], and non-academic Regents grades make up the lowest third of our distribution of correlation coefficients.

There are several general observations that might well be made from our first table. First, the leading position of the languages seems to imply that facility with words plays an outstanding part in success in the first two years in a college of arts and sciences. This fact, together with the position of English and the social and physical sciences, all requiring much reading, emphasizes the need of reading ability as well as of a broad vocabulary, or a general linguistic ability.

The second observation is that Regents grades for the more advanced high school classes give higher correlation coefficients with our two-year college average than do the more elementary ones in the same field.

Thirdly: when correlation coefficients are calculated separately for the two sexes, it is interesting to note that the coefficients are quite generally higher for girls than for boys. Of the fifty-seven relationships established between college average and various measures, the *r's* were higher for boys than for girls in the case of chemistry Regents, the Opposites sub-test of the American Council Examination, Regents English grammar, Regents intermediate algebra, and the Mathematics sub-test of the Iowa Content Examination. The relationships were of practically the same size for the two sexes for Latin IV Regents, the French I school examination, sub-tests English and Physical Science of the Iowa Content Examination, Regents physics, age at high school graduation, and the Analogies sub-test of the American Council Examination. There remain forty-five relationships for which the girls show higher relationship than the boys, all of which confirms the findings of other studies.

Fourthly: colleges located within the State of New York, or any region having a strongly centralized secondary school examining body, have a very considerable advantage in their prediction of college grades. At the present time much is being written concerning the value of cumulative record cards showing, among other things, scores on a series of fairly reliable standardized tests. The results of the present research would seem to indicate that the Regents System of this state has done much to provide such scores. In addition to this provision of fairly reliable standard scores, the Regents-passing goal, held to by most New York State secondary schools, has a remarkably stabilizing and standardizing effect upon the grading of work within the high school. In this connection, attention is called to the fact that the average school marks in the foreign languages and English usually correlate with college average better than do the most recent Regents scores in these fields. Further data substantiating this hypothesis will be presented subsequently.

---

[13] See note 9, this chapter. The narrow spread of ability of our subjects undoubtedly explains in large part the relatively low *r's* obtained between the American Council Psychological Examination total and sub-tests and academic success as displayed by our two-year college average and grades received in individual college subjects. This factor undoubtedly also operates with regard to the Regents average, Regents language scores, and the like, so that one might well expect higher *r's* between the Regents average and the two-year college average, for instance, in a college having the wide range of student ability found in some of the large mid-western state universities.

See Chapter V for a discussion of relationships obtained between this Psychological Examination and college success in other colleges and universities.

[14] Although mathematics frequently gives comparatively low prediction coefficients there is probably a definite reason for the extremely low *r's* of the Regents mathematics grades with college success; namely, there is in the schools a considerable repetition of mathematics Regents examinations at both ends of the distribution of student ability. The very able students, in large percentages, repeat intermediate algebra and geometry examinations to raise grades already above the passing level. This is done in competition for the New York State Regents scholarships which depend in part on scores in these two subjects. At the other end of the distribution of ability, the poorer students are particularly likely to fail and, therefore, repeat geometry and the algebras. See Sarbaugh, M. E. *Op. cit.*

Regression Equations for the Variables, Regents Average and College Average

The following regression equations were calculated for the prediction of college success from total Regents average:

Boys: $y = .071\,x - 1.8$; P.E. of estimate of $y = .39$
Girls: $y = .067\,x - 1.44$; P.E. of estimate of $y = .29$
Total $y = .070\,x - 1.7$; P.E. of estimate of $y = .37$

In these prediction formulae, y equals the dependent variable, college average; x equals the high school Regents average. These regression equations, to be certain, are useful only for the specific university for which the data were gathered. This reservation, of course, also holds for relationships herein generally established.

The probable error of the estimate, as shown above, indicates that, using the formulae at hand, there is a "fifty-fifty" chance that the estimates from these formulae will be only between .3 and .4 of a letter grade from the actual college performance. For the girls especially, our prediction device is seen to have considerable reliability.

Table II A, B, and C[15] are an attempt to show more simply what our correlation coefficients between Regents average and the two-year college average (r.64 for the total group) mean. In these tables the Regents average is classified in intervals of five; 65 to 69.9; 70 to 74.9; . . . . ; 85 to 89.9; those over 90.0. Table A shows that of the boys entering the University of Buffalo with a Regents average of 90 or better, thirty-six per cent made a college average of B+ or better; an additional twenty-seven per cent, or a total sixty-three per cent made B or better in their first two years of college attendance; twenty-seven per cent made C+; while the remaining ten per cent made C's. No boy entering with a Regents average of 90 was in anywise a failure.

Table II B shows that sixty per cent of the girls with a Regents average of 90 made a two-year college average of B or better; thirty-two per cent made C+; while only eight per cent made C or C— grades. There were also no failures among the girls of this group.

Turning to students entering with Regents averages between 85 and 89.9, the percentage of exceptionally high college averages is considerably less than for those with an average over 90 at entrance. However, forty-four per cent of the boys and fifty-one per cent of the girls made college averages of B or better; an additional forty-three per cent of the boys and thirty-seven per

---

[15] These tables are a condensation of the original scattergrams used to obtain correlation coefficients.

Table II

TOTAL HIGH SCHOOL REGENTS AVERAGE AND FRESHMAN AND SOPHOMORE COLLEGE AVERAGE GRADES

TOTAL H. S. REGENTS AVERAGE	COLLEGE GRADES												TOTAL
	A AND B+ 6.0—5.4		B AND B− 5.3—4.8		C+ 4.7—4.2		C AND C− 4.1—3.6		D+ AND D 3.5—3.0		LESS THAN D 2.9—		
A. Boys													
90 –	4	36%	3	27%	3	27%	1	10%					11
85 –	5	10	18	34	23	43	5	9	1	2%	1	2%	53
80 –	1	1	15	13	48	44	24	22	19	17	3	3	110
75 –			6	4	24	16	56	39	50	34	10	7	146
70 –					3	4.5	22	33	29	43	13	19.5	67
65 –					2*		2*				1*		5
Total	10	3	42	11	103	26	110	28	99	25	28	7	392
B. Girls													
90 –	7	28%	8	32%	8	32%	2	8%					25
85 –	2	4	24	47	19	37	6	12					51
80 –	1	1.5	7	11.5	27	44	19	31	6	10.5%	1	1.5%	61
75 –					9	16	39	70	7	12	1	2	56
70 –					1	4	10	44	8	35	4	17	23
65 –											1	100	1
Total	10	5	39	18	64	29	76	35	21	10	7	3	217
C. Boys and Girls													
90 –	11	30.5%	11	30.5%	11	30.5%	3	8.5%					36
85 –	7	7	42	40	42	40	11	11	1	1%	1	1%	104
80 –	2	1	22	13	75	44	43	25	25	15	4	2	171
75 –			6	3	33	16	95	47	57	29	11	5	202
70 –					4	4	32	36	37	41	17	19	90
65 –					2*		2*				2*		6
Total	20	3	81	13	167	27	186	31	120	20	35	6	609

* Too few cases to give reliable percentage differences.

cent of the girls made C+ college averages; the remainder, except for four per cent failing boys, made C's. There is a significant tendency for these students to achieve better than average college grades.

It is quite impossible to predict with any degree of accuracy how successful an individual student entering with a Regents average between 80 and 84.9 will be in college. Fourteen per cent of the boys and thirteen per cent of the girls made college grades of B or better; twenty per cent of the boys and twelve per cent of the girls made averages of D or less; the remainder, of course, made C+'s, C's and C—'s. The group on the average make average grades, though individuals within it range from complete success to total failure.

Of those with Regents averages between 75 and 79.9, only four per cent of the boys and no girls at all made B or better; sixteen per cent of both boys and girls made C+ averages in college; forty-one per cent of the boys and fourteen per cent of the girls average D or poorer; the remainder make C's and C—'s. Of those entering with averages of 70 to 74.9, only four and one-half per cent of the boys and four per cent of the girls reach the high average grade of C+, thirty-three per cent of the boys and forty-four per cent of the girls made C's and C—'s; while sixty-two and one-half per cent of the boys and fifty-two per cent of the girls made D or less; that is, more than half of this group did not do satisfactory work.

There are too few students entering with Regents averages lower than 70 to give reliable percentage differences.

To summarize: students with averages over 90 produce largely superior and very superior college students. Students with averages over 85 may be expected to do satisfactory work in college, and in a large percentage of the cases are superior students. Students with averages between 80 and 84.9 do average work as a group, occasionally superior, occasionally inferior. One cannot predict what the individual students in this group will do; but their work is of such caliber that colleges should be ready to accept them. Students with averages below 80 are very rarely exceptional students, though approximately half do college work above the failing level. Approximately three-fifths of the students with Regents averages below 75 are unsatisfactory students; the remaining two-fifths do C grade work. Almost never is such a student above average in college attainment.

A college wishing to raise its standards might do well to refuse entrance to students with Regents averages below 75, and perhaps to those between 75 and 80. All students entering with averages below 80 should be advised that the chances are against their doing satisfactory college work. Even students entering with averages between 80 and 85 might well be told that there is a one in five chance of their not being satisfactory.

High School Fifth

Tables III A, B, and C were constructed to determine whether the Regents average differentiates between good and poor college students better than

Table III

HIGH SCHOOL FIFTH AND FRESHMAN-SOPHOMORE COLLEGE AVERAGE

HIGH SCHOOL FIFTH	COLLEGE AVERAGE												TOTAL
	A AND B+ 6.0—5.4		B AND B− 5.3—4.8		C+ 4.7—4.2		C AND C− 4.1—3.6		D+ AND D 3.5—3.0		LESS THAN D 2.9—		
A. Boys													
1st	6	6.1%	29	29.3%	39	39.4%	18	18.2%	5	5.0%	2	2.0%	99
2nd	3	2.2	12	8.7	45	32.6	46	33.4	26	18.8	6	4.3	138
3rd			5	4.6	18	16.7	32	29.6	38	35.2	15	13.9	108
4th					3	8.3	8	22.2	22	61.9	3	8.3	36
5th					2	8.3	9	37.5	10	41.7	3	12.5	24
Total	9	2.2	46	11.4	107	26.4	113	27.9	101	24.9	29	7.2	405
B. Girls													
1st	9	8.8%	31	30.4%	26	35.3%	24	23.5%	2	2.0%			102
2nd	1	1.5	8	12.2	21	31.8	28	42.4	6	9.1	2	3.0%	66
3rd					3	9.4	19	59.3	7	21.9	3	9.4	32
4th					1	12.5	3	37.5	3	37.5	1	12.5	8
5th					1	12.5	2	25.0	3	37.5	2	25.0	8
Total	10	4.6	39	18.1	62	28.7	76	35.2	21	9.7	8	3.7	216
C. Boys and Girls													
1st	15	7.4%	60	30.0%	75	37.2%	42	21.0%	7	3.4%	2	1.0%	201
2nd	4	2.0	20	9.8	66	32.3	74	76.3	32	15.7	8	3.9	204
3rd			5	3.6	21	15.0	51	36.4	45	32.1	18	21.9	140
4th					4	9.1	11	25.0	25	56.8	4	9.1	44
5th					3	9.4	11	34.4	13	40.5	5	15.7	32
Total	19	3.0	85	13.7	169	27.2	189	30.5	122	19.6	37	6.0	621

does the high school fifth[16]. It will be noted that seven per cent[17] of the boys in the first fifth of their class, two per cent of the girls, and four per cent of the total do not do satisfactory work. Thirty-five per cent of the boys, thirty-nine per cent of the girls, and thirty-seven per cent of the total first fifth students make B or better. Being in the first fifth of his class does not assure an entering freshman the probability of success or the unlikelihood of failure that having a Regents average over eighty-five would. Of the students in the fourth and fifth fifths, eight per cent of the boys, twelve and one-half per cent of the girls, or nine per cent of the total make C+. This is a definitely higher proportion of high average students than is found among students entering with Regents averages under seventy-five, although the number of cases is larger for the latter high school measurement. One may conclude that the Regents average predicts college achievement better than does the high school fifth.

It is, however, interesting to note that no student from the lower two-fifths of his graduating class has made better than a C+ record; that is, no such student has ever done better than high average college work. In fact, no girl and but five per cent of the boys from the middle fifth ever attain better than a C+ record. At the lower end of the scale of academic achievement, the high school fifth is more selective than at the upper levels; although even here, the Regents average is a better selector.

An explanation of the inferior prediction value of the high school fifth as compared with the total Regents average is not difficult to find. A comparison of these two variables shows that the high schools in Buffalo's suburbs, the non-Buffalo up-state cities, and the rural small towns have, in the order mentioned, a significantly lower Regents average for their first fifth people than the Buffalo schools. The 193 Buffalo first fifth students within the group studied herein have an average of 86.1 for all "academic" Regents subjects. All non-Buffalo first fifth students at this University averaged 83.1 for their Regents subjects. Residential suburb first fifth students averaged 84.4; non-Buffalo up-state city first fifth students, 83.0; and non-suburban small town first fifth students averaged 81.7.

The 134 Buffalo high school second fifth students had a Regents average of 80.3 which is but slightly lower than the first fifth non-suburban small town first fifth students. The non-Buffalo city high school second fifth students have an average closely approximating that of the Buffalo schools, 80.0. The residential suburb second fifth average 77.8, and the non-suburb small town high school second fifth average 78.0 on their "academic" Regents subjects.

To recapitulate[18], when high school fifth is used to predict college success, students from large urban and from small rural high schools are lumped together. Due entirely to larger student populations, the level of attainment of the upper groups for the latter are much lower than for the former, as measured by such objective tests as the Regents Examinations. That is to say, first fifth rural high school students are reliably less able than first fifth students in the larger schools, and, therefore, cannot be expected to be as successful in college as the latter. The same argument holds for each successive fifth.

---

[16] This measure is an average of all high school grades received by the individual except of those from the final term before graduation. No Regents grades are included. The twenty per cent of students receiving the best of such school averages are considered the first fifth of their class.

[17] In order to increase the numbers within each school to the point of reliable differences, all entrants for the year 1930 were included in addition to those of the five-year period considered in the main body of the study.

[18] Other differences between schools within and outside of our urban area will be discussed in a later section.

TABLE IV

MULTIPLE CORRELATION COEFFICIENTS BETWEEN THE TWO-YEAR COLLEGE AVERAGE AND VARIOUS MEASURES

TWO-YEAR COLLEGE AVERAGE WITH	R
H. S. English Ave. and Regents Amer. Hist.	.59
Total Regents Ave. and H. S. English Ave.	.64*
Total Regents Ave., H. S. English Ave. and Regents Amer. Hist.	.64
Total Regents Ave. and Age at H. S. Graduation	.64
Total Regents Ave. and Total Iowa Content	.67
Total Regents Ave., Total Iowa Content and Total American Council Psychological Examination	.67
Total Regents Ave., Total Iowa Content, Total American Council Psychological Examination and Age at H. S. Graduation	.67

* Attention is called to the fact that the zero-order correlation coefficient between the total Regents average and our criterion is .64.

Combinations of Various Predicting Measures

Table IV considers the multiple correlation coefficients between the two-year college average and various combinations of measures obtainable from the high school record card or the examinations given just prior to college entrance. Inasmuch as statistically combining such criteria is a time-consuming task, only those items which gave high zero-order correlation coefficients were used, and only for those measurements which we have for practically all our entrants: age, total Regents average, total Iowa Content, total American Council Psychological Examination, and the two senior high school subjects required of all high school graduates, high school English and Regents American history. These items were taken in different combinations.

It will be noted that the combination of school English average (not including Regents marks) with American history does not give as high a correlation as does the total Regents average. Adding these two measurements to the Regents average does not raise the coefficient of correlation perceptibly. Adding age to the Regents average is an equally profitless job. Combining the total Iowa Content with the Regents average to predict college average raises the relationship from r.64 to R.67. The addition of the total American Council Examination does not further raise the relationship, nor does the addition of the variable age at high school graduation.

It is obvious that the small increase of .03, the most that was obtained by any combination, does not justify the involved statistical procedure necessary to derive a multiple regression equation, nor, having the equation, are the calculations necessary in individual prediction justified. More profitable would be the division of the total entering student body into more homogeneous groups; e.g., sex or high school, and relating the Regents average to college average for such groups.

Regents Average in School Groups

Table V was constructed to determine whether the Regents average predicts college average more effectively in certain schools than in others, particularly to compare large high schools with the smaller ones in the suburban and rural villages; also to determine whether within a more homogeneous population, such as that from one large high school, the Regents average might predict better than for the total freshman group, made up of students from a large variety of secondary schools.

The correlation coefficients for all but one Buffalo high school were higher[19] than for the total group of entrants. Three Buffalo schools and the combined residential suburb schools, all produced *r's* of .75 or over between Regents average and college average for the total population of boys and girls from these institutions.

The non-suburb small towns sent the University of Buffalo no boy with a Regents average over eighty-five and but two girls, these with averages less than ninety. The cosmopolitan non-Buffalo schools sent us but one student, a girl, with an average over ninety, and only eight per cent of the boys with averages over eighty-five. This restricted spread of student achievement within the non-predictive range of Regents averages drastically reduced the size of the *r*, though the percentage technique used in Table II gives results very comparable to those for the total group. That is to say, those with Regents averages above eighty-five are very good risks, those below seventy-five are in a very large proportion poor college students, those between seventy-five and eighty are likely to be below average, while the large number of entrants who come with grades between eighty and eighty-five are average students, some superior, some inferior.

Comparing the second item of Table I with the last on Table V, it will be noted that the adding of the 1930 freshman group changes the correlation coefficient for the boys from r.61 to r.58; for the girls, from r.73 to r.72; for the total, from r.64 to r.65. These differences are all less than the probable error of the coefficient for the five-year period, and empirically establish the size of the *r*.

---

[19] The trend of the relationship between the Regents average and college average varies from school to school. In this connection the author hopes to publish further concerning differences between schools. Dr. R. S. Woodworth has suggested the possibility that the change of residence for out-of-town students with subsequent adaptation to the new habitat-situation may be a factor reducing the relationship of our variables for such groups.

Table V

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN TOTAL REGENTS AVERAGE AND TWO-YEAR COLLEGE AVERAGE BY SCHOOLS AND TYPES OF SCHOOLS

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Buffalo Schools:						
No. 1	68	.66	53	.81	121	.75
No. 2	17		6		23	.79
No. 3	51	.45	22	.57	73	.61
No. 4	88	.65	37	.83	125	.68
No. 5	76	.63	58	.70	124	.66
No. 6	25	.77	25	.75	50	.75
No. 7	9		1		10	
No. 8	4		5		9	
Non-Buffalo Schools:						
Cities	72	.49	24	.58	96	.53
Residential Suburbs	26	.77	22	.64	48	.76
Non-suburb small towns	35	.37	19	.42	54	.41
Industrial suburbs	6		1		7	
Total Buffalo Schools	338	.60	207	.76	545	.67
Total Non-Buffalo Schools	139	.52	66	.55	205	.54
Grand Total 6-yr. Student Body	477	.58	273	.72	750	.65

II. PREDICATION OF AVERAGE COLLEGE MARKS FOR SELECTED SCHOOL GROUPS

Dates showing when individual high school courses were taken are not included in the information sent by the high school to the college. It was, therefore, impossible to determine such measures as senior year high school average from data available in the college files. Furthermore no mention as to exact rank in graduating class was included among the data concerning the individual student sent by the secondary school. It was, therefore, necessary to go to the individual school for such information. Time did not permit visiting all schools sending graduates to the University of Buffalo. Since between two-thirds and three-fourths of our student body comes from Buffalo, further data were collected concerning the total college student group coming from representative institutions from this area.

Senior Year Regents Average, Total and Senior Year School Averages, and Rank in Graduating Class

The hypothesis was presented that possibly the average of Regents examinations passed during the last year at high school might give a better relation with college work than does that for all Regents examinations of an "academic" nature taken during the total high school attendance. To test this hypothesis as well as to throw some light on the relationship between school averages and Regents averages, the following measures were calculated for all students coming from two large Buffalo high schools: senior "academic" Regents average, senior school average and total school average for complete high school attendance. Table VI shows that the senior Regents average produces correlation coefficients with the two-year college average slightly lower than does the complete high school Regents average. This is not surprising, since senior year grades present a smaller sample of an individual's total academic accomplishment than does the latter measure. Not only will any emotional disturbance present in the senior year vitiate the picture of a student's academic life, but such minor things as a bad cold during Regents week may seriously change a fair record. This together with the fact that colleges generally wish to have predictive material earlier than the June previous to freshman entrance makes the senior Regents average an unlikely measure to use.

The school average for total high school attendance at the two institutions investigated is just as good for prediction as is the Regents average. The two schools are large Buffalo schools, the student body of one being largely first generation American born of very varied nationality background living in Buffalo's "interstitial"[20] areas; the student body of the second being almost entirely of children of skilled labor and professional American stock.

TABLE VI

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN TWO-YEAR COLLEGE AVERAGE AND TOTAL REGENTS AVERAGE, SENIOR YEAR REGENTS AVERAGE, TOTAL SCHOOL AVERAGE, SENIOR YEAR SCHOOL AVERAGE, AND PLACE IN GRADUATING CLASS BY SCHOOLS

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
School Number One						
Total Regents Ave.	68	.66	53	.81	121	.75
Sr. yr. Regents Ave.	64	.62	51	.70	115	.65
Place in Class	43	.62	41	.72	84	.66
Total School Ave.	52	.73	42	.78	94	.74
Sr. yr. School Ave.	64	.64	51	.76	115	.69
School Number Four						
Total Regents Ave.	88	.65	37	.83	125	.68
Sr. yr. Regents Ave.	89	.63	38	.64	127	.64
Place in Class	79	.57	36	.87	115	.66
Total School Ave.	90	.63	38	.88	128	.71
Sr. yr. School Ave.	89	.66	38	.83	127	.71
School Number Three						
Total Regents Ave.	51	.45	22	.57	73	.61
Place in Class	47	.25	25	.57	72	.50
School Number Five						
Total Regents Ave.	76	.63	58	.70	124	.66
Place in Class	63	.45	55	.56	118	.53
Total of Four Schools						
Total Regents Ave.	283	.60	170	.74	453	68
Place in Class	265	.52	157	.67	422	.60

---

[20] See Thrasher, F. M., *The Gang; a Study of 1,313 Gangs in Chicago,* University of Chicago Press, Chicago, Ill. 1927.

Findings reported by other investigators leave us surprised at the size of our correlation coefficients between the school averages obtained within these two schools and the two-year college average obtained at this University. We have no evidence at this writing to substantiate our belief that this would not hold in groups which included not only Buffalo, or other large city, high school graduates together with graduates from small town schools. Our reasoning depends upon the fact that the top fifth students from such small schools in nowise equal those from the larger schools in Regents grade attainment and upon our suspicion that teachers in such small schools will, in spite of Regents grades to the contrary, give as large a percentage of school grades of 90 and above as do teachers in large urban institutions. We hope to investigate this further and publish again.

Table VI contains also the relationships between college two-year average and the rank in his graduating class earned by each student on the basis of all school grades except those from the last semester prior to graduation[21]. Such data were gathered for all students from four Buffalo schools. It will be noted that these *r's* are with but one exception lower than for the Regents average with success during the first two years at this University. Some of the differences are great. As a single predictive measure, the rank in the graduating class is inferior to the total Regents average within the individual school. With the inclusion of graduates from small and rural high schools, it will, in all probability, become increasingly inferior in proportion as the group studied is of mixed origin.

Combining Regents Average and Rank in Class

Table VII gives the relationship between rank in high school graduating class and total Regents average by schools and for the total of the four schools studied. The *r's* vary between r.63 and r.85. For the four schools for which we have rank in class, the *r* between this rank and Regents average is r.68 for boys, r.77 for girls, and r.69 for the combination of the two sexes. These figures are almost the same as those between total Regents average and two-year college average. In other words, the Regents average for "academic" subjects passed during the entire period for which the individual attended high school is as closely related to the high school average, at least within large urban schools, as it is to college success during the first two years of college attendance. One might well consider this Regents average as a measure of scholastic aptitude in high school *and* college, a measure of that complex of factors which produce academic success, which probably includes such items as motivation, intelligence-test ability, language facility, home background, and the like.

The multiple R (a statistical combination of variables) between college average and the combined place in class and Regents average is .02 points higher than the zero-order *r* between college average and Regents average by

---

[21] See Hull, C. L. *Op. cit* for statistical handling of this material.

TABLE VII

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN RANK IN HIGH SCHOOL AND HIGH SCHOOL REGENTS AVERAGE BY SCHOOLS

SCHOOLS	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
No. 1	52	.73	40	.85	92	.79
No. 3	44	.71	22	.82	66	.78
No. 4	85	.63	34	.85	119	.74
No. 5	70	.75	54	.63	124	.68
Total of Four	251	.68	150	.77	401	.69

itself. It is, therefore, evident that the addition of rank in graduating class to the Regents average betters our prediction device by so little as to be of practically no value. With the addition of small town schools, one may expect a lessening of the value of rank in graduating class, inasmuch as within these smaller schools, the class rank, because of the comparatively diminutive size of the classes involved, loses significance. Whenever a Regents average is available for an entering freshman, at least at this University, no increase in the betting system may be expected by obtaining the rank in graduating class, since this measure is not as good as our best "guessing system", and its addition does not better this system reliably.

III. COLLEGE SOPHOMORE COOPERATIVE TESTING BUREAU PROGRAM

During the spring of 1932, the majority of achievement tests of the battery sponsored by the Cooperative Testing Bureau[22] in their annual college sophomore testing program was administered to the sophomores at this University. Our sophomores, as a group, tested above average in gross score, were definitely superior in general science (due largely to the number of premedical and pre-dental students), and were comparatively poor in the general culture test.

Inasmuch as this measure of general college success was available, and especially since it should satisfy demands for objectifying such success, it was deemed worth while investigating relationships between it and measures available at college entrance.

Relationships were calculated between the total Regents average and the gross score resulting from the testing procedure described above. An r.66 was obtained for the 109 students for whom gross score and total Regents average were available. That is, the relationship between Regents average and sophomore success as measured by the total of these short-item tests was approximately the same as that measured by average college marks (r.64) for the two years. That is to say, whether we measure success or failure in the first two years of college work by the average of course grades or by short-item tests, the Regents average is equally related to such success.

---

[22] New York City, N. Y.

Interesting, though not particularly related to the main body of our investigation, is the fact that the Regents average is more closely related to the gross scores for the sophomore tests than these are to the average of grades for either the freshman or sophomore year in college (r.45 and r.53 respectively). Whether this means that there is a greater overlap of content between high school training, as measured by Regents average, and the college sophomore test content than between the Cooperative tests and freshman and sophomore college work, or whether these relationships but emphasize the general predictive value of the Regents average for academic success is not clear. The author would rather suspect that the latter is the case.

IV. SUMMARY AND IMPLICATIONS

1. The purpose of the research described in this chapter is to select that single measure which best predicts college success as measured by the freshman and sophomore college average, as well as to determine what combination of measures will give the best total relationship with such college success.
2. Correlation coefficient together with percentage comparisons were used to measure the relationship between success in college and such measures as were available.
3. The average of all Regents marks except such "non-academic" subjects as music, shop-work, commercial courses, and the like, gave the best single relationship of those thoroughly investigated.
4. Ancient and modern foreign language Regents grades and school averages produced higher correlation coefficients with college success than any measure except the Regents average; and in the case of the French and German *school* averages, as high as the Regents average.
5. Of the tests administered, the total Iowa Content Examination and the History sub-test of the Iowa Content give the best relationships, with our criterion of college success, being exceeded by only the total Regents average, modern and ancient languages, and the high school English average.
6. The English, science, history, and trigonometry Regents grades take a middle position in the amount of relationship to the two-year college success criterion.
7. The mathematics and "non-academic" Regents marks, age at high school graduation, the total and sub-tests of the American Council on Education Psychological Examination and the Iowa Content Mathematics sub-test are least related to college success of the measures studied.
8. Even though the fifth of the class in which a student is graduated will give considerable indication as to the caliber of college work which may be expected from him, still this measure is less closely related to success in college than the Regents average.
9. Within a more limited population, students from four Buffalo high schools, it was found (1) that neither the senior year Regents average nor the senior year school average was as closely related to college success as the

total Regents average; (2) that the total school average was as good a predictor of college success as the Regents average; (3) that rank in graduating class is not as good as our best "guessing measure", and its addition does not improve this system reliably.

10. For students from four Buffalo schools, the Regents average is related to high school average to the same degree as it is to the two-year college average.

11. The gross score resulting from the Cooperative Sophomore Testing Program is as closely related to the total Regents average as is the two-year college average grade. The gross score from the Sophomore Testing results is more closely related to the Regents average than to either the freshman or the sophomore college average.

12. When our student population was divided into groups according to graduating high school, the relationship between Regents average and college average varied from group to group, in the majority of cases giving higher *r's* than for the total student body.

13. There is no significant increase in the relationship of total Regents average with our two-year college criterion by statistically combining with this Regents average other available measures. Dividing a total student body into more homogeneous groups, e. g. by graduating school or sex or age, and then developing prediction formulae for such groups will be found more fruitful. The high relationships obtained for some of the individual schools studied or for the girls as contrasted with the boys or total group of students are cases in point.

14. Colleges having a student body which is largely graduated from New York State high schools might well profit in their selection of students by using the total "academic" Regents average to predict both average college grades, and, as will be shown in the next chapter, specific course success. With investigators indicating the value of cumulative record cards showing comparative scores on standard tests over a period of years, the New York State Regents Department may point with pride to its work in this direction. Not only is the Regents average very valuable in prediction, but also Regents and school grades in the modern and ancient languages may be used with considerable reliability, at least in this University, to predict freshman-sophomore college success.

In addition to the provisions of fairly reliable predictive scores, the Regents-goal, held to by most New York State secondary schools, seems to have a stabilizing and standardizing effect upon the grading of work of the high school student regardless of the size, location, or type of population of the school considered. The fact that high school averages and Regents averages for both total high school attendance and senior year grades for large Buffalo schools predict so nearly alike is one case in point. The high predictive value of the high *school* language and English averages is a second argument in this direction.

CHAPTER III

PREDICTION OF SPECIFIC COLLEGE FIELD AND COURSE PERFORMANCE

THE previous chapter describes an attempt to predict average college performance during the first two years of college attendance without any consideration of the type of curriculum[1] attempted by the individual student. Within this chapter[2] are studied such measures as were available at college entrance to determine which of these data are particularly related to success and failure in the specific fields of English, mathematics, ancient and modern languages, the social, and the physical sciences, as well as in individual college courses. Results here, as in the preceding chapter, are based, unless otherwise specified, upon the complete group of individuals studied, who, during the five year period under consideration, presented the item or items being investigated. The use of such results is wider than a mere prediction of performance in the various fields. They may well be used to select from available curricula the one in which a given individual is most likely to succeed, and so serve in individual educational guidance.

I. PREDICTING PERFORMANCE IN COLLEGE ENGLISH

More of our freshmen and sophomores study English than any other subject. During the period for which these data were gathered, freshman English was required. This is no longer so, and yet it is a generally elected subject by majors in other fields as well as by those intending to specialize in English itself. For this reason we have placed it first in our chapter.

Table VIII shows prediction coefficients for (1) average performance for all English courses carried during the first two years of college attendance, (2) freshman college English[3], and (3) sophomore college English[4]. The total

---

[1] Specific college major, *e.o.*, English, Mathematics, Modern Languages, and the like.

[2] For a general summary, implications, and conclusions concerning the data presented in this chapter, the reader is referred to Chapter IV. The present reading may be found tedious for those who dislike tables and statistical descriptions. The present chapter presents detailed results particularly for those interested in investigating within their own environment relationships between specific high school and college classes and between college classes and individual test marks. It may well be found of value to those employed in guiding high school students into fields for which each is fitted.

[3] Listed in the catalog as English 101-2, largely a composition course.

[4] Listed in the catalog as English 201-2, a survey of English literature from Beowulf to Hardy.

Regents average consistently shows the closest correspondence with all measures of English performance; freshman English, sophomore English, and English average for all classes carried during the first two years at college, with one exception. Regents Latin III is the highest in the list of *r's* with the two-year English average. Except for this relationship, the total Regents average shows distinctly higher *r's* than any other measure.

The English sub-test of the Iowa Content Examination, the average of all *school* marks in English earned during high school attendance, and the final Regents grade received in high school English give the next highest correlation coefficients with college English success.

It should be noted that the sub-test Opposites of the American Council Psychological Examination is more closely related to English performance for the boys than for the girls. For freshman English and for the average of the two years' English performance for the boys, it exceeds all measures except the Regents average and the Iowa Content English; for sophomore English, it ranks higher than all except freshman college English and ties with the Regents average. For boys, this measure is of evident value in predicting success in this field, and might well be used for advisement purposes.

The total Iowa Content Examination is very valuable in predicting college English for girls, ranking higher for average English performance than all

Table VIII

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN COLLEGE ENGLISH AND VARIOUS MEASURES

		AVE. 2-YR. COLLEGE ENG.		FRESHMAN ENGLISH		SOPHOMORE ENGLISH	
		No.	r	No.	r	No.	r
Total Regents Ave.*	Boys	250	.57	250	.54	214	.37
	Girls	151	.65	151	.64	139	.59
	Total	401	.62	401	.61	353	.50
Total Regents Ave.	Boys	390	.53	388	.49	376	.42
	Girls	217	.65	217	.63	212	.49
	Total	607	.60	605	.58	598	.48
Regents English IV	Boys	429	.47	430	.43	406	.36
	Girls	229	.58	229	.58	224	.42
	Total	658	.47	659	.53	630	.43
Rank in H. S. Class*	Boys	263	.47	264	.43	226	.34
	Girls	157	.60	157	.62	145	.56
	Total	420	.57	421	.54	371	.49
Iowa Content English	Boys	341	.52	346	.47	318	.40
	Girls	141	.58	140	.49	138	.42
	Total	482	.57	486	.50	456	.45
H. S. English Ave.	Boys	334	.39	336	.40	320	.26
	Girls	184	.33	184	.48	180	.34
	Total	518	.52	520	.49	500	.39

TABLE VIII—(Continued)

		AVE. 2-YR. COLLEGE ENG.		FRESHMAN ENGLISH		SOPHOMORE ENGLISH	
		No.	r	No.	r	No.	r
A. C. E. Opposites	Boys	422	.51	424	.44	404	.42
	Girls	230	.45	230	.47	225	.30
	Total	652	.49	654	.49	629	.38
Regents Latin III	Boys	245	.64	245	.40	237	.38
	Girls	157	.68	157	.52	154	.43
	Total	402	.68	402	.49	391	.43
Regents English III	Boys	425	.39	426	.41	**	
	Girls	232	.42	232	.48		
	Total	657	.45	658	.48		
H. S. English I	Boys	383	.39	385	.36		
	Girls	200	.33	199	.39		
	Total	583	.45	584	.41		
Regents English II	Boys	409	.32	411	.34		
	Girls	224	.44	224	.44		
	Total	633	.43	635	.44		
Total Iowa Content	Boys	340	.46	342	.45	325	.38
	Girls	141	.62	141	.58	138	.47
	Total	481	.50	483	.47	463	.39
Regents Eng. Literature	Boys	52	.07	52	.34	52	.17
	Girls	55	.60	54	.52	53	.41
	Total	107	.21	106	.44	105	.31
A. C. E. Completion	Boys	422	.40	424	.40	404	.27
	Girls	230	.44	230	.49	225	.35
	Total	652	.37	654	.41	629	.28
A. C. E. Total	Boys	416	.39	417	.38	400	.28
	Girls	229	.27	229	.48	224	.33
	Total	645	.35	646	.40	624	.28
Regents Eng. Grammar	Boys	266	.27	267	.34		
	Girls	163	.18	163	.29		
	Total	429	.30	430	.35		
A. C. E. Art. Lang.	Boys	422	.21				
	Girls	230	.44				
	Total	652	.30				
Age at H. S. Grad.	Boys	421	−.18				
	Girls	215	−.18				
	Total	636	−.23				
No. of H. S. Units	Boys	430	.09				
	Girls	232	.27				
	Total	662	.22				
A. C. E. Analogies	Boys	358	.14				
	Girls	146	.15				
	Total	504	.12				

---

* Cases from only four large Buffalo high schools over a six year period. The rank in class as presented here cannot be compared with all *r's* presented in this table since the small high schools with their more variable student populations are not included.

** Inasmuch as time did not permit the calculation of all possible interrelations, the less likely ones have been omitted.

except the total Regents average; likewise for freshman English, except that in this case Regents English IV ties with it. For girls, the total Iowa Content exceeds all measures except Regents average and freshman college English in its relation to sophomore English grades. For the girls, the final Regents English examination is also consistently high in the list of *r's*.

The exact rank in the high school graduating class earned by each individual was available for students from four large Buffalo high schools. This measure ranks high in predictive value for such school populations. It is anticipated, however, that adding individuals from smaller schools will probably cut down on the magnitude of the relationship between rank in graduating class and college English success.

In predicting college sophomore English, the Regents average is surpassed by college freshman English. This is consistent with findings for other collegiate departments, in that almost invariably within a field of knowledge, a freshman course will predict sophomore college work better than any measure available at college entrance.

A considerable percentage of our five year group took more advanced classes in English than the general sophomore course. Grades for these more advanced courses were averaged; and relationships between such averages and other available measures were calculated. For this criterion, freshman college English gave the best prediction coefficient. The English sub-test of the Iowa Content Examination and the Regents average gave the two next highest *r's* (r.48 and r.46 respectively). The high school English average is some ten points lower, and is closely followed by Regents English IV, the Opposites sub-test, and the total American Council Psychological Examination. However, except for freshman grades in this field no measure was related to advanced college English as high as r.50.

Grades were examined for one more course included in the catalog under English: a course in public speaking. The English sub-test of the Iowa Content and the total American Council Psychological Examination are higher in their relationship to this course than any other measure studied; although for these, the coefficients are only in the neighborhood of r.40. This is one of the very few freshman courses for which the Regents average does not predict better than, or at least almost as well as, any other measure.

The Cooperative English Test

In an attempt to improve our "guessing system" so far as success in college English is concerned, the Cooperative English Test[5] was administered to entering freshman classes. Correlation coefficients were calculated between freshman college English and both the Mechanics portion of this test (fifty minutes of testing time devoted to grammar, spelling, and punctuation) and the total test (which includes, in addition, one hundred vocabulary words and two hundred items of literary information). The correlation coefficients between the grades in freshman English and the total and parts of the Cooperative English Test for the two classes entering in 1931 and 1932 are given in the above table. Two coefficients are included for the sophomore English course survey of literature; (1) with the combined Literature and Vocabulary sub-tests of the Cooperative English Test and (2) with the total examination.

---

[5] Published by the Educational Records Bureau, New York City, N. Y.

Freshman English is more closely related to the gross score on the Cooperative English Test than to any of the sub-tests. The correlation between these two variables for the 1931 freshman group is r.58; while for the 1932 comparable group, it is r.62. The total Mechanics sub-test is second in size of those with freshman English: r.49 for the class entering in 1931, and r.61 for the following year's group. The highest relationship obtained for the five-year group described in the previous section was with the Regents average (r.61 between this subject and the Regents average for students from four Buffalo high schools, and r.58 for the total body of entering freshmen). The difference in size of relationship, insofar as they favor either the Regents average or the Cooperative test results, are negligible. It cannot be said justly that either is superior to the other in predictive value. However, for students within New York State, the Regents average may be obtained with no investment of students' time, less clerical work, and no test-cost. For non-New York State secondary students, on the other hand, the Cooperative test should be very valuable.

TABLE IX

CORRELATION COEFFICIENTS BETWEEN COLLEGE ENGLISH COURSES AND THE COOPERATIVE ENGLISH TEST, TOTAL AND SUB-TESTS

COMBINATION OF SCORES AND GRADES	NO. CASES	r
Cooperative Sub-Test Mechanics and		
English 101* '31	189	.49
English 102* '31	189	.34
English 101-2* '31	186	.49
English 101-2 '32	148	.61
Combination Cooperative Sub-Tests Vocab. and Lit. and		
English 101-2 '31	189	.50
Cooperative Sub-Test Vocabulary and		
English 101-2 '32	145	.51
Cooperative Sub-Test Literature and		
English 101-2 '32	145	.40
Total Cooperative English Test and		
English 101-2 '31	189	.58
English 101-2 '32	149	.62
Combination Cooperative Sub-Tests Vocab. and Lit. and		
English 201-2**'31	47	.49
Total Cooperative Test and English 201-2 '31	47	.62

* English 101-2 is the freshman course in this field; 101 is the first term and 102 the second.
** English 201-2 is the sophomore course in this field.

The relationship between the total Cooperative English Examination with the sophomore college English grades is r.62. This combination of sub-tests is definitely better than the total test (r.49) in its predictive value of sophomore English. The best relationship obtained in the preceding section was r.59 between freshman and sophomore college English. It will be noted that neither the freshman English grade nor the total Cooperative score is superior to the other in predicting sophomore English. However, freshman grades can usually be obtained without any expenditure for tests and test correcting or additional investment of students' time.

The Nelson-Denny Reading Test

The 1931-32 entering freshman class took the Nelson-Denny Reading Examination[6]; subsequently many enrolled in freshman English. The correlation between grades in this course (1) with total Reading Test scores was r.51; (2) with the Paragraph Reading sub-test, r.33; and (3) with the Vocabulary sub-test, r.49. It will be remembered that, especially for boys, the Opposites sub-test of the American Council Psychological Examination gave fairly high relations to freshman English. The Vocabulary sub-test of the Nelson-Denny substantiates our findings that a good vocabulary is advantageous in English courses. However, all three correlation coefficients with Paragraph, Vocabulary and total, are lower than those between our criterion and either Regents Latin III, Regents English IV, average high school grade in English, or the total Regents average. They are also lower than that between our criterion and the total Cooperative English test as described above. Except for this last mentioned test, however, both the total Nelson-Denny test and its ten-minute Vocabulary sub-test rank among the best *test* predictors available. They tie with the Opposites sub-test of the American Council Psychological Examination and with the English sub-test of the Iowa Content Examination.

Combinations of Various Predicting Measures

To investigate the possibility of improving prediction of English success by the use of the multiple correlation technique (a statistical combination of variables), the following calculations were performed. Complete data were available for 189 of the 1931-32 freshman class. Zero-order coefficients[7] of correlation were calculated between freshman English grades and the total Nelson-Denny Reading test (r.51), Opposites sub-test of the American Council Psychological Examination (r.49), total Cooperative English Test (r.58), age at high school graduation (r-.30), Regents English IV (r.57), and total American Council Psychological Examination (r.40). Using these, the following multiple correlations were obtained with grades in freshman college English:

1. Nelson-Denny total examination and age at high school graduation R.57

---

[6] Prepared by M. J. Nelson and E. C. Denny. Printed by Houghton Mifflin Co.

[7] Selection of measures in the investigation depended upon (1) their availability, (2) the size of the *r* in our earlier statistical investigation, as above, and (3) the popularity of measures outside of our college.

2. Regents English IV and age at high school graduation R.59
3. Cooperative English total examination and age at high school graduation R.61
4. Cooperative English and the Opposites sub-test of the American Council Examination R.62
5. Cooperative English total and Regents English IV R.69
6. Cooperative English total, Regents English IV, and age at high school graduation R.69
7. Cooperative English total, Regents English IV, and total Nelson-Denny R.69
8. Cooperative English total, Regents English IV, and Opposites sub-test of the American Council Examination R.69

It will be noted that combining age at high school graduation with any single other measure raises the resulting coefficient in the neighborhood of .02 or .03. However, when the variable age is added to a combination already established, e. g. to Cooperative English plus Regents English IV, it does not further increase correspondence. The combination of Cooperative English total Examination plus Regents English IV, statistically combined, gives the best multiple coefficient.[8] Adding to this combination either age at high school graduation, the total Nelson-Denny Reading test scores, or the Opposites sub-test of the American Council Examination does not further increase the size of the relationship.

College Sophomore Testing Program Results

In order somewhat to objectify success in college English, the English and General Culture portions of the Cooperative College Sophomore Testing Program[9] results were substituted for average college English grades in the following investigation. Test data were available for the 1931-32 entering freshman class. Coefficients of correlation between these portions of the Sophomore Testing Program and measures available at college entrance are shown in Table X.

The total Regents average is related to the total English sophomore test (r.63) and to the combined total English and General Culture sub-examinations (r.62) in about the same degree that it is related to average college English grades (r.60). That is to say, the Regents average predicts college English performance about equally well, whether the latter is measured by an objective short-item examination or by the usual college grading procedure.

Average high school English predicts the sophomore English test scores (r.71) definitely better than it predicts the average college English grades

---

[8] The regression equation to be used in predicting freshman English at this University is $x_1 = .04\ x_2 + .18\ x_3 + .58$, where x_1 = freshman college English grades, x_2 = Regents English IV marks, and x_3 = Cooperative English total in standard scores ranging from 1 for the poorest to 10 for the best.
The P. E. of the estimate of $x_1 = 0.4$.
Example: if x_2 (Regents English IV) = 90,
and $x_3 = 8$ (ca 80th centile)
then $x_1 = 3.6 + 1.44 + .58 = 5.6 \pm .4$ (where a college grade of A = 6, B = 5, and so on).

[9] See footnote 22, Chapter II.

(r.47). Also the Regents English IV examination is more closely related to the sophomore test performance (r.57) than to college English average (r.47). The higher relationship between high school English average and the college sophomore English test is due probably to an actual overlap of the content of secondary school English class-work and items of the test. This, of course, is to a certain extent also true for the English course content of the two academic levels.

TABLE X

COEFFICIENTS OF CORRELATION BETWEEN ENGLISH AND GENERAL CULTURE SUB-TESTS OF THE COOPERATIVE TESTING BUREAU SOPHOMORE EXAMINATION AND MEASURES AVAILABLE AT HIGH SCHOOL GRADUATION

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Total Regents Ave.						
Total Soph. English Test	69	.64	44	.57	113	.63
General Culture Soph. Test	68	.51	43	.62	111	.55
Total English and Gen'l Culture	67	.63	42	.58	109	.62
Literature	68	.48	44	.45	112	.50
Vocabulary	71	.58	44	.41	115	.53
Regents English IV						
Total English Soph. Test	73	.63	47	.30	120	.57
General Culture	71	.43	45	.32	116	.40
High School English Ave.						
Total English Soph. Test	57	.73	28	.56	85	.71
General Culture Soph. Test	55	.49	28	.36	83	.41

Except for average high school English, the correlation coefficients with either college English grades or sophomore test success are lower for high school English measures than for the total Regents average. In other words, the Regents average is generally more predictive than other measures regardless whether these other measures are high school courses in the same field or in other fields, or are test score results.

Summary Regarding College English Prediction

1. When predicting the success of a student in college English, disregarding sex, the following are indicative and valuable: total Regents average, the total and Mechanics sub-test of the Cooperative English Examination, Regents marks in Latin III and English IV, scores on the sub-test English of the Iowa Content Examination, the total and Vocabulary sub-test of the Nelson-Denny Reading Test, and average school grades in secondary English. The two first mentioned are the best.

2. For a boy, knowledge of words, such as is shown by the sub-test Opposites of the American Council Psychological Examination, indicates to a considerable extent his potentialities in the field of English.

3. For girls, a broad knowledge, such as is shown by a good score on the Iowa Content Examination, is significant in foretelling success in the field of English. In general, a girl's previous class performance has more significance than does a boy's, while a boy's word knowledge is more important.

4. For large schools, rank in graduating class is indicative of college English success.

5. Freshman English grades predict sophomore or more advanced college English success more reliably than does any variable studied except the total Cooperative English Examination.

6. Success in a public speaking course, though fairly unpredictable, is more closely related to success on the total American Council Psychological Examination and the English sub-test of the Iowa Content than to any other variable investigated, although even here the relationships are too low for reliable prediction of individual performance.

7. The Nelson-Denny Reading Test is inferior not only to total Regents average and total Cooperative English test but also to Regents Latin III, Regents English IV, and average secondary school marks in English in predictive value for success in freshman college English. It ties with the Opposites sub-test of the American Council Examination and the English subtest of the Iowa Content. Data on this test were available for only the 1931-32 entering freshmen.

8. The best combination of measures for the prediction of freshman English is Cooperative English total Examination and Regents English IV. The total Regents average was not included in these calculations, nor were data available at this writing for more than the 1931-32 freshmen. The results are nevertheless suggestive.

9. For average college English performance, Regents Latin III is outstandingly better than any other measure studied. Subsequently it will appear that this Regents grade is valuable in predicting *averages* in fields other than its own and English.

10. The Regents average is related to average college grades in English and to scores on the Cooperative College Sophomore English Examination to the same degree. Regardless whether college course grades or short-item "objective" test results be taken as our criterion of success in college English, the Regents average predicts such success equally well.

11. The comparatively high relationship between the total English portion of the Sophomore Testing Program and the average high school grade in this subject suggests that possibly the Sophomore test examines for material learned in secondary school. On the other hand, the higher reliability of the short-item examination (as contrasted with college grades) might possibly be a factor in producing a relatively high *r*. This latter explanation is not a likely one, since the Regents average is as closely related to college grade averages as to college achievement test scores.

II. PREDICTING COLLEGE MATHEMATICAL PERFORMANCE

Predicting performance in mathematics at the University of Buffalo is an ineffectual activity. The only measure which gave a prediction coefficient of r.50 or more with any college mathematics criterion is Regents trigonometry with average college freshman and sophomore mathematics. Since less than twenty-five per cent of those taking mathematics in college have taken trigonometry in high school, this subject cannot be used for prediction purposes in the large majority of cases.

Except for trigonometry, the highest relationship obtained with average freshman and sophomore mathematics is Regents Latin III, which is closely followed by Regents average; these two, with trigonometry, are the only measures related to average mathematics as closely as r.40.

For freshman mathematics (a combination of college algebra and trigonometry, or algebra and analytical geometry whenever the student has had high school trigonometry), the Iowa Content sub-test in Mathematics gives

Table XI

ZERO-ORDER CORRELATIONS BETWEEN THE AVERAGE OF FRESHMAN AND SOPHOMORE MATHEMATICS AND VARIOUS OTHER MEASURES

(Correlations are listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Regents Trigonometry	67	.50	14		81	.51
Regents Latin III	154	.46	55	.42	209	.44
Total Regents Ave.*	159	.42	41	.43	200	.41
Total Regents Ave.	262	.41	78	.41	340	.39
Regents Interm. Algebra	282	.33	81	.44	363	.35
Rank in Grad. Class*	166	.34	44	.48	210	.36
Total Iowa Content	222	.35	50	.18	272	.34
Iowa Content Math.	220	.29	52	.27	272	.28
Regents Solid Geom.	50	.22	9		59	.28
Regents Geometry	283	.23	81	.28	364	.26
A. C. E. Analogies	236	.22	51	.42	287	.25
Regents Elem. Algebra	275	.17	76	.45	351	.24
No. of H. S. Units	289	.24	83	.34	372	.24
Regents Amer. Hist.	255	.21	75	.18	330	.21
Total A. C. E.	261	.18	80	.21	341	.20
A. C. E. Arithmetic	285	.18	81	.31	366	.19
Iowa Content Science	224	.18	50	.18	274	.17
Regents Adv. Algebra	49	.19	12		61	.17
Age at H. S. Grad.	287	−.22	79	−.22	366	−.15
A. C. E. Art. Lang.	285	.15	81	.03	366	.14
A. C. E. Opposites	285	.11	81	.13	366	.11
Iowa Content English	225	.19	50	.02	275	.05
A. C. E. Completion	285	.03	81	.12	366	.04

* See footnote, Table VIII.

Table XII

ZERO-ORDER CORRELATIONS BETWEEN FRESHMAN COLLEGE MATHEMATICS AND VARIOUS OTHER MEASURES

(Correlations are listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Regents Trigonometry	57	.39	16		73	.56
Regents Ave.*	134	.41	40	.65	174	.44
Iowa Content Math.	189	.42	70	.32	259	.40
Regents Latin III	144	.39	53	.35	197	.38
Total Regents Ave.	232	.39	65	.24	297	.36
Rank in Grad. Class*	138	.31	40	.45	178	.34
Total Iowa Content	191	.35	45	.28	236	.33
Regents Interm. Algebra	245	.30	77	.40	322	.32
Regents Geometry	248	.26	77	.32	325	.31
Regents Adv. Algebra	42	.30	13		55	.29
Regents Solid Geometry	42	.19	9		51	.27
Total A. C. E.	241	.18	71	.22	312	.19
Regents Elem. Algebra	237	.14	33	.13	270	.18

* See footnote, Table VIII

r.40 for the total group having taken the test. The following measures give relationships between r.30 and r.40: rank in graduating class for the four schools studied, total Iowa Content, and Regents Examination in Latin III, intermediate algebra, and geometry.

As is usually found, there are higher correlation coefficients for the relationships obtained for the girls than for the boys, or for a combination of the two sexes. The following coefficients with freshman college mathematics are significantly higher for the girls than for the boys or for the total: r.65 with Regents average; r.42 with rank in graduating class; r.40 for Regents intermediate algebra. The following coefficients with average college mathematics are significantly higher for the girls than for the boys or for the total: r.48 with rank in graduating class; r.42 with the sub-test Analogies of the American Council Psychological Examination; and r.45 with Regents elementary algebra.

All college mathematics courses of a level higher than freshman were averaged together. The only correlation coefficient higher than .40 was that between freshman mathematics and this advanced average (r.52). The Regents average gave a correlation coefficient of r.36 with this average, intermediate algebra of r.29. All other coefficients with this criterion were lower.

A partial explanation of the low correlation coefficients between Regents mathematics scores and both the two-year college average and individual college mathematics courses is the high percentage of students who repeat courses in this field[10], both at the upper and the lower levels of ability. This, however, does not explain the fact that the Regents average predicts in other fields much more reliably than in college mathematics, and that the tests investigated all predict better in all other fields than in mathematics. One turns to those experiments[11] which indicate a verbal factor as contrasted with a number factor as a partial explanation of the low relationships in general between mathematical grades both in high school and college and those other measures which seem to cluster around verbal facility.

---

[10] See Sarbaugh, M. E., "Articulation of High School and College," *The University of Buffalo Studies*, 1934, IX, 174-183.

III. PREDICTING COLLEGE LANGUAGE PERFORMANCE

There are various measures which are related to average college language performance and to the individual courses with correlation coefficients over r.50. It will be remembered that the high school languages were related more closely to average college performance than any other variable except the average of all "academic" Regents marks. So, too, of all college marks, the languages are most easily predicted; that is, they seem to display more of that constellation of personality traits which makes for general academic success than is shown in any other division of college attainment.

The series of tables on the following pages show that for college language averages and the introductory college languages, the Regents average stands at the top or very near the top of the list of predictive relationships. The correlation coefficients between this Regents average and the various introductory languages or college language average range from r.54 for the total group in introductory French to r.66 for introductory college German.

High school French average and Regents French III produce correlation coefficients with the various college language criteria that closely approach those of the Regents average in size, and in the absence of a Regents average will have value in predicting college language performance.

Regents Latin IV gives higher correlation coefficients with the various college language performances than does Regents Latin III. For general language prediction, however, the former has one handicap. This subject is taken by less than one-fourth of the entering student body. Regents Latin III and high school Latin average might well be used also in estimating college performance in not only Latin but the other languages as well, since these subjects quite consistently give correlation coefficients over r.50 with college language criteria.

Of the tests and sub-tests examined in this study, it should be noted that the Opposites sub-test and the total of the American Council Psychological Examination and the English sub-test and the total of the Iowa Content Examination show more correlation coefficients[12] over .40 with the college language criteria used than they do with any other division of college training.

---

[11] Schneck, M. M. R., Measurement of Verbal and Numerical Abilities, *Archives of Psychology,* No. 107.

[12] Possibly it should be remembered in this connection that correlation coefficients of .50 improve prediction of individual scores about thirteen per cent above chance; and correlations of .40 permit prediction to about nine to ten per cent better than chance. Holzinger, K. J. *Statistical Method for Students in Education.* Boston. Ginn and Co. 1928, pp. 166-167.

In addition to the above very general remarks about the prediction of language, there are specific items worth attention. The first is in connection with the prediction of advanced college French. It should be noted (See Table XV) that the high school French average, the total Regents average, Regents Latin III, and the college freshman course in French all predict about equally well advanced work in French at college. The high school French average, the Regents Latin III, and the freshman college French scores predict reliably better for girls than for boys; while the Regents average gives the highest correlation coefficient obtained for the latter group for advanced college French.[13]

The Cooperative French Test was administered to those 1931-32 entering freshmen who had had some French in high school and who intended continuing with French in college. Relationships were established between the intermediate or second year of college French and test scores for the twenty-two individuals for whom these data were at hand. An r.47 was obtained. This is definitely inferior to those with Regents average, Regents French II, or introductory college French. Scores on this test were related to the advanced course in college French, the third year of the subject, with a resulting r.52 for the twenty-eight cases available. This criterion has not been related to any other measure at the present time; but considering the high relationships obtainable for the languages, the coefficients given above are probably not the highest obtainable.

Again, the high correlation coefficients occasionally found in Tables XIV and XVI, which consider the prediction of college German, are of interest. The relationship between introductory German and average advanced college German of r.80 for thirty-eight cases together with the coefficients over .70 between introductory German and Regents average and between this course and Latin III for girls may but reflect a special situation at the University; and yet the correlation coefficients between the freshman-sophomore college average and high school German average, Regents German III, and the school mark in German I were also over .70[14] for the girls.

Thirdly, for the twenty-seven individuals who took advanced Latin in college, the following predictive correlation coefficients were obtained: with total Regents average, r.76 PE .05; with first year college Latin r.77 PE .06; with the total American Council on Education Psychological Examination, r.69 PE .09. For the thirty-six individuals who took Greek in college, the correlation coefficient with this Greek average and the total Regents average was r.60 PE .07. These comparatively high correlation coefficients for the advanced classics may be related to the comparatively small classes in these

---

[13] This is in line with a general difference noted between the girls and the boys: that specific course grades and other measures of attainment predict better for girls, while more general measures and tests, which tap the limits of power and speed, seem to predict better for the boys. It is probable that the boys are less evenly motivated, particularly in high school, and that, as a consequence, measures of specific accomplishment are diluted in their relationship by a variable motivation. In the case of girls, motivation is less variable and at a higher pitch and measures of accomplishment more closely reflect the picture of the girl's general attack on things academic.

[14] It might be of interest to note here than an *r* of .70 increases the accuracy of individual case prediction by about thirty per cent over chance. See Holzinger, K. J. *Op. cit.*

TABLE XIII

ZERO-ORDER CORRELATIONS BETWEEN AVERAGE COLLEGE LANGUAGE AND VARIOUS MEASURES

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Total Regents Ave.*	201	.55	149	.71	350	.63
Total Regents Ave.	301	.52	211	.69	512	.59
H. S. French Ave.	109	.29	124	.68	233	.59
Regents French III	84	.55	82	.69	166	.54
Regents Latin III	198	.51	153	.65	351	.53
H. S. German Ave.	39	.39	21	.63	60	.51
Rank in Grad. Class*	206	.50	153	.46	357	.58
Regents Latin IV	30	.12	67	.81	97	.46
Regents English IV	330	.27	223	.46	553	.39
A. C. E. Opposites	320	.27	221	.43	541	.34
Total Iowa Content	252	.27	134	.47	386	.33
Regents Amer. Hist.	296	.20	202	.43	498	.31
H. S. English Ave.	256	.05	178	.53	434	.30
A. C. E. Art. Lang.	320	.16	221	.40	541	.29
Total A. C. E.	305	.16	220	.42	525	.27
Age	222	−.26	207	−.27	429	−.26
No. of H. S. Units	326	.11	223	.25	549	.20
A. C. E. Completion	320	.08	221	.41	541	.18
Regents English Grammar	212	.15	157	.14	369	.16

* See note, Table VIII.

subjects in that all members of such classes are probably highly motivated. A high degree of motivation will reduce the variability of performance at any level of ability, and the higher reliability of the measure automatically raises the relationship obtained. This factor is likely operating also in German classes in both high school and college, more especially in the higher levels of attainment in this field.

The introductory and advanced courses in Spanish are also comparatively small, and for this reason tables have not been included showing the relationship between Spanish course accomplishment and various measures. During the five year period, there were forty-four students who took introductory college Spanish during their first two years of college attendance. The highest correlation coefficients for this subject was with the total Regents average; for the thirty-one girls, the *r* is .76 PE .06; for the total forty-one cases for whom a total Regents average was available, the *r* is .69 PE .06. A coefficient of r.68 PE .08 between introductory Spanish and Regents Latin III was found for the twenty-seven cases presenting this high school subject. Using the grades of thirty-one students who took this college course and their Iowa Content sub-test English score, a relationship of r.49 PE .09 was obtained. All other relationships calculated were less than r.40.

Grades for advanced college Spanish, as well as for other advanced college language courses, are easy to predict. The relationship between introductory college Spanish and advanced college Spanish for the sixteen cases at hand was r.92 PE .03; between Regents Spanish II and advanced college Spanish average, r.69 PE .06 for the total thirty-two cases for which both measures were to be had. For the forty-seven cases available, the correlation of Regents average with advanced college Spanish average was found to be r.60 PE .06. Against the same criterion the total Iowa Content and Iowa Content English

Table XIV

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN INTRODUCTORY COLLEGE LANGUAGES AND VARIOUS MEASURES

		LATIN		FRENCH		GERMAN	
		No.	r	No.	r	No.	r
Total Regents Ave.	Boys	24	.41	54	.50	49	.54
	Girls	73	.64	36	.55	29	.73
	Total	97	.59	90	.54	78	.66
Regents Latin III	Boys	21	.19	32	.47	46	.46
	Girls	73	.66	23	.74	27	.75
	Total	94	.58	55	.59	73	.58
H. S. Latin Ave.	Boys	17					
	Girls	62	.58				
	Total	79	.58				
Regents Latin IV	Boys					5	
	Girls					13	
	Total					18	.64
H. S. French Ave.	Boys	7					
	Girls	45	.54				
	Total	52	.55				
Iowa Content English	Boys	11		36	.37	50	.39
	Girls	32	.39	24	.44	12	
	Total	43	.34	60	.43	62	.39
Iowa Content Total	Boys	11		40	.28	48	.13
	Girls	17	.37	24	.51	16	.45
	Total	28	.06	64	.40	64	.22
Regents English IV	Boys			50	.40	64	.42
	Girls			37	.18	32	.51
	Total			87	.33	96	.46
A. C. E. Opposites	Boys	22	.24	53	.44	65	.40
	Girls	74	.37	37	.17	31	.42
	Total	96	.27	90	.30	96	.42
A. C. E. Total	Boys	22		51	.15	62	.35
	Girls	73	.26	37	.17	31	.44
	Total	95	.26	88	.14	93	.39
Regents Eng. Grammar	Boys	21	−.02	36	−.10	44	.44
	Girls	57	.26	28	.21	23	.21
	Total	78	.18	64	.07	67	.38

sub-test give correlation coefficients of .48 PE .10 and .47 PE .09 respectively. The situation is found in Spanish as in the advanced classics and German; the classes are small and the relationships high.

At first blush, high correlation coefficients were expected between Regents English grammar and the various college language criteria. Investigation of our figures reveals that, in spite of comparatively high relationships found between knowledge of English grammar and language proficiency by other investigators[15], no coefficient over .20 was found here between Regents English grammar and college language average or individual language courses. An intimate knowledge of the high school student body in Buffalo suggests a possible explanation for this condition. It was found that the better English students at the secondary level often take the Regents examination in English grammar without having studied the course as such at all. They do this to make up a necessary half unit for high school graduation or merely to increase the number of high school units to their credit. The poorer students carry English grammar one semester five times per week and then take the Regents examination in the subject. The examination may be taken anywhere from the end of the sophomore year of high school to the end of the senior year. If separate relationships were established for those students who had attended the course and another for those who had not, it is probable that in both cases the coefficients between this measure and any college language mark considered would be higher. Such relationships might be further increased if the taking of the subject were confined to some one year of secondary school attendance.

Summary Regarding Language Prediction

1. Languages are more easily predicted than any other field of college endeavor.

TABLE XV

ZERO-ORDER CORRELATIONS BETWEEN ADVANCED COLLEGE FRENCH AND VARIOUS MEASURES

(Correlations are listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
H. S. French Ave.	99	.48	115	.65	214	.58
Total Regents Ave.	176	.55	174	.56	350	.56
Regents Latin III	115	.42	125	.66	240	.56
Freshman French	29	.39	25	.73	54	.55
Iowa Content English	144	.37	102	.47	246	.44
Regents English IV	178	.33	182	.42	360	.43
Regents Latin IV	23	.41	54	.46	77	.42
Total Iowa Content	143	.24	114	.50	257	.33
Total A. C. E.	178	.25	181	.37	359	.30
Regents English Grammar	116	.32	130	.003	246	.19

---

[15] Monroe, R. E. "Adapting Instruction to the Ability of the Student in the Romance Languages" and Gausewitz, Walter. "Adapting Elementary German to the Needs of the Gifted Student", *Service Studies in Higher Education*, Ohio State University Press. Columbus, Ohio, 1932, pp. 124ff and 136ff.

2. The Regents average is the best general index to average college language success and to success in any specific language.
3. Regents Latin III and IV as well as high school or college language grades within the same language field are highly indicative of subsequent success.
4. Success in College Latin, Greek, and advanced courses in the modern languages is particularly easy to predict.
5. The Cooperative French test does not foretell success in College French as well as either previous high school or college training in the field.
6. Regents English grammar does not predict college language success.

TABLE XVI

ZERO-ORDER CORRELATIONS BETWEEN ADVANCED COLLEGE GERMAN AND VARIOUS MEASURES

(Correlations are listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Introductory College German	34	.80	4		38	.80
Regents German III	25	.64	12		37	.56
H. S. German Ave.	34	.50	14	.68	48	.55
Total Regents Ave.	65	.41	23	.50	88	.43
Regents German II	43	.43	18	.25	61	.40
Regents English IV	81	.31	24	.24	105	.32
Iowa Content English	63	.20	14		77	.18
Iowa Content Total	63	.13	13		76	.12
Total A. C. E.	82	.08	25	.29	107	.08

IV. PREDICTING PERFORMANCE IN COLLEGE SOCIAL SCIENCE

Average performance for either college languages or college English is definitely easier to predict than that for social sciences. For the latter, the only *r* over .50 is with total Regents average, this being r.56 for the 560 individuals who had taken some social science in college. The total Iowa Content test, its sub-test in English, and Regents Latin III (Cicero), are all related to average college social science to the degree expressed by r.40 or over. Rank in high school graduating class for four selected Buffalo schools is related to this social science average for both girls and total group to the degree expressed by r.40. The only measures sufficiently related to average social science to deserve mention are for the girls: to wit, Regents American history (r.52), Regents English IV (r.42), Regents biology (r.41), and Regents ancient history (r.44). All relationships for boys result in a lower coefficient.

It seems to the author of interest to note that a Regents examination score in ancient history or biology obtained at the end of her high school freshman year will predict a girl's social science average in college as well as the Iowa

Content Examination and better than a score on the widely used American Council Psychological Examination, both taken at freshman college entrance. For boys, however, the total Iowa Content Examination is definitely a better prediction device than are these Regents subjects, although not as good as the Regents average. This is consistent with findings in previous sections to the effect that definite subject examinations give better relationships for girls and tests of more general information measuring power rather than enduring motivation, give higher correlations for the boys.

Social Science Orientation Course

During the second semester of their freshman year, many students take an orientation course in the social sciences[16]. During the early portion of the period investigated, the various departments lectured to the total student body taking this course, while more recently, one individual gives all the physical science and another all the social science lectures. Relationships were established for predicting performance in this orientation course. However, only the measures which had proven useful for the average two-year social science performance were investigated, while those giving low relationships with the latter were not.

Table XVII

ZERO-ORDER CORRELATIONS BETWEEN AVERAGE COLLEGE SOCIAL SCIENCE AND VARIOUS MEASURES

(Correlations listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Total Regents Ave.	347	.56	213	.58	560	.56
Total Regents Ave.*	248	.41	147	.58	395	.49
Total Iowa Content	304	.47	137	.46	441	.46
Iowa Content Eng.	308	.41	137	.40	445	.44
Regents Latin III	242	.42	155	.40	397	.42
Rank in Grad. Class*	262	.37	156	.50	418	.42
Regents Amer. Hist.	386	.28	204	.52	590	.37
Regents Biology	266	.29	196	.41	462	.36
A. C. E. Opposites	375	.37	226	.31	601	.36
A. C. E. Total	369	.29	225	.37	594	.32
Regents English IV	427	.23	225	.42	657	.30
Iowa Content Hist.	341	.31	104	.13	445	.30
Regents Ancient Hist.	377	.22	197	.44	574	.29
A. C. E. Completion	375	.26	226	.38	601	.28
H. S. English Ave.	333	.19	182	.36	515	.24
Iowa Content Science	307	.29	137	.23	444	.23
No. H. S. Units	383	.17	228	.20	611	.22
Age at H. S. Grad.	419	−.19	211	−.22	630	−.21
Regents Economics	73	.15	16		89	.18
A. C. E. Art. Lang.	375	.10	226	.25	601	.17

* See footnote to Table VIII.

---

[16] The first semester was devoted to a similar course in the physical sciences.

The highest correlation coefficient with our orientation course for the second semester was with total Regents average; r.44 for 172 boys, r.66 for 185 girls, and r.59 for the total group. Regents Latin III and Regents American history stood next in size of *r*, followed closely by the Iowa Content total. For the girls, Regents biology and Regents ancient history are related to the degree of r.50 and r.44 respectively. Of those investigated, all other relationships are less than r.40. It should be noted that no relationships were established for the various sub-tests of the Iowa Content Examination and the criterion. Other relationships with these sub-tests would indicate that the sub-tests of History and English might be expected to correlate with an orientation course in social science to the degree of at least r.40, possibly higher.

History in College

The most frequently attended history class at this institution is one in European history, a course usually taken by freshmen. Practically all the variables studied (see Table XVIII) are related to this course to the degree

Table XVIII

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN THE COLLEGE HISTORIES AND VARIOUS MEASURES

		EUROPEAN		AMERICAN		ENGLISH	
		No.	r	No.	r	No.	r
Total Reg. Ave.	Boys	83	.34	35	.29	91	.39
	Girls	157	.58	34	.55	23	.28
	Total	239	.54	69	.36	114	.40
Reg. Latin III	Boys	54	.32	28	.51	69	.54
	Girls	106	.43	21	.62	17	
	Total	160	.40	49	.54	86	.50
Reg. Amer. Hist.	Boys	81	.53	36	.52	90	.30
	Girls	150	.46	33	.46	24	.11
	Total	231	.51	69	.51	114	.27
Iowa Content Total	Boys	66	.57	24	.44	79	.25
	Girls	90	.46	24	.48	17	
	Total	156	.49	48	.38	96	.19
Iowa Content Hist.	Boys	64	.43	24	.41	75	.33
	Girls	91	.52	25	.44	18	
	Total	155	.46	49	.41	93	.22
Iowa Content English	Boys	65	.57	24	.35	74	.21
	Girls	90	.40	25	.52	18	
	Total	155	.49	49	.37	92	.27
Reg. Ancient Hist.	Boys	83	.42	39	.31	83	.24
	Girls	144	.50	32	.34	22	.47
	Total	227	.45	71	.31	105	.26
A. C. E. Total	Boys	93	.30	39	.36	92	.13
	Girls	163	.35	34	.41	23	
	Total	256	.32	73	.36	115	.11

expressed by r.40. For the total student body taking the course, the total Regents average and the American history Regents examination are related to the degree of r.56 and r.51 respectively. For the boys, the Iowa Content total and sub-test English together with the Regents American history give *r's* over .50; for the girls, the highest relationships are obtained for total Regents average, Iowa Content sub-test history, and Regents ancient history respectively.

The course in English history, given largely to pre-law college freshmen, is related to Regents Latin III[17] (r.50 for total 86 students) more highly than to any other variable investigated. The total Regents average is second in size of correlation coefficient. It is actually .10 lower. All other relationships are less than r.30 and definitely below any prediction value.

The measure most closely related to American history in college is a one-term college course in general social science[18], the coefficients of correlation being r.57 for the thirty-four boys, r.70 for the thirty-two girls, and r.61 for the total group who had taken both courses. College American history is usually taken as a sophomore subject, and except for the occasional individual who takes this history course prematurely, general social science class grades may be used to good advantage in its prediction. The next most closely related measure is Regents Latin III (Cicero), which is closely followed by Regents American history. For the girls, the total Regents average and the English sub-test of the Iowa Content Examination are related to performance in college American history to the degree expressed by r.55 and r.52 respectively. All other relationships are less than r.50; the Iowa Content total and sub-test History are next highly related to our criterion.

As a means of objectifying college course grades in history, the Regents average was related to the history section of the College Sophomore Testing Program. The two correlated to the degree r.46. As above shown, college grades in European history were related to Regents average to the degree of r.54; college American history grades to the degree of r.36; and English history as shown by r.40. The relation for the sophomore testing history examination is approximately equal to that for the average of the three college course grades.

Economics and Government in College

Of those variables investigated, Regents Latin III best predicts accomplishment in the college course in government—r.68 for the total group who both had had Latin III in high school and took government in college. The next best relation for the total group was with the total Regents average; this being highest for the boys. For girls, Regents biology is related to government to the degree expressed by r.66, a relation surprisingly high considering that biology is taken as a high school freshman class and that the content of the courses are quite different. The four Regents subjects investigated, Latin III, American history, ancient history, and biology, are all more closely related to this college course than either the total Iowa Content or American Council Psychological Examination.

---

[17] It is possible that Latin IV Regents would be more valuable in prediction as measured by size of coefficient than Latin III, but since this fourth year of high school Latin has been taken by only one-fifth of our entering freshmen, it has not been examined for relationship to specific fields. Possibly too the average high school French grade would give relationships of size equal to those obtained with Latin III, inasmuch as this measure predicts average college attainment slightly better than Latin III. However, space and time have prevented the inclusion of relationships with this average.

[18] See section on Social Science Orientation Course for a description of this class.

Table XIX

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN COLLEGE COURSE GRADES IN GOVERNMENT AND ECONOMICS AND VARIOUS MEASURES

		GOVERNMENT		INTRO. ECON.		ADV. ECON.	
		No.	r	No.	r	No.	r
Total Reg. Ave.	Boys	49	.61	235	.25	90	.52
	Girls	20	.55	91	.47	15	.52
	Total	69	.58	326	.31	105	.51
Reg. Latin III	Boys	38	.43	146	.53		
	Girls	13		60	.38		
	Total	51	.68	206	.47		
Iowa Content Total	Boys	47	.25	206	.33	102	.26
	Girls	12		63	.57	16	
	Total	59	.26	269	.39	118	.23
Iowa Content Hist.	Boys	47	.29	209	.30	104	.30
	Girls	12		64	.69	15	
	Total	59	.35	273	.35	119	.29
Regents Amer. Hist.	Boys	49	.41	241	.33		
	Girls	20	.42	92	.41		
	Total	69	.42	333	.35		
A. C. E. Total	Boys	51	.39	254	.25	109	.22
	Girls	23		97	.62	19	
	Total	74	.35	351	.33	128	.28
A. C. E. Opposites	Boys	51	.46	256	.32		
	Girls	23	.10	98	.40		
	Total	74	.35	354	.34		
Reg. Ancient Hist.	Boys	46	.43				
	Girls	19	.49				
	Total	65	.44				
Reg. Economics	Boys			57	.42		
	Girls			7			
	Total			64	.49		
Intro. College Econ.	Boys					114	.61
	Girls					16	
	Total					130	.57
Regents Biology	Boys	46	.32				
	Girls	22	.66				
	Total	68	.47				

For the total five year group, Regents economics best predicts (r.49) performance in introductory college economics, but unfortunately, for prediction purposes, less than one-tenth of our entering students have had this course in high school. A combination (multiple correlation coefficient) of Regents economics and total American Council Examination nets a relationship of R.55 for those who had had high school economics.

Regents Latin III stands second in size of *r* of all single measures used. For the total group of students, the *r's* for both Latin and high school economics is slightly under r.50. For the boys, Regents Latin III is related to our criterion subject to the extent expressed by r.53; for the girls, the best predictive measures are the total Iowa Content and sub-test History and the American Council Examination total with r.57, r.69, and r 62 respectively. The relationships for the girls are in general much higher than for the boys for this subject. This is possibly due to the fact that girls are less likely to take this course — that is to say, only those girls who are particularly motivated and interested register for work in this field.

The 1931-32 freshman class had been given the Nelson-Denny Reading Test[19] at entrance. Forty-five of this group took the introductory course in economics the same year. The correlation coefficients between grades received in this course and the total Reading test was r.45. The Paragraph Reading subtest was related to success in this course to the extent of r.53. Comparing these figures to those in the preceding paragraph, it is obvious that this test is as good a predicting device for introductory economics as any so far herein studied.

The American Council Economics test[20] scores for the 1931-32 freshmen were related to introductory economics grades with a resulting r.67 for the seventeen cases for whom all data were available. This relationship is definitely higher than any other obtained with this course. However, it should be pointed out that the test can be used only with those who have had some previous training in the subject prior to their taking the introductory work in this field.

To summarize: for those who have had high school economics, the American Council Economics Test and the Regents economics examination are definitely superior predictive measures. In the absence of such previous training, the Paragraph Reading sub-test of the Nelson-Denny Reading test would give best predictive results. Regents Latin III might also be found valuable.

An average was calculated for all advanced economics courses taken by students of our five-year group during the first two years of their college attendance. College introductory economics and the total Regents average give the best coefficients of correlation with this average (See Table XIX). That is to say, to predict advanced work in this field, earlier college work is the best measure (r.57). Average high school attainment, as measured by

---

[19] See footnote 6, this chapter.

[20] Constructed by H. Taylor, T. N. Barrows, and Ben D. Wood. Published by the World Book Company.

Regents Examinations, is next best (r.51). All other measures, so far as they have been investigated, give relationships of less than r.30.

Psychology and Sociology

For the total five-year group, on whom the majority of this research has been made, there were only two measures which were related to introductory psychology to the extent of r.50. These are total "academic" Regents average (for boys r.53, and for combined boys and girls r.51) and sub-test History of the Iowa Content (r.55 for girls). However, for the 1931-32 freshmen, the Nelson-Denny Reading Test provided relationships of about the same size. The relationship between psychology grades and the total test was r.48 for the total fifty students for whom complete data were available. The Paragraph Reading sub-test of the Nelson-Denny was related to psychology grades to the extent of r.55 for this same group; and the Vocabulary sub-test, to the extent of r.48. It is anticipated that a reading test, the content of which was more similar to psychology, might well predict better than any high school datum.

The relationships obtained with sociology are definitely lower than for

TABLE XX

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN PSYCHOLOGY AND SOCIOLOGY AND VARIOUS MEASURES

		PSYCHOLOGY		SOCIOLOGY	
		No.	r	No.	r
Total Regents Ave.	Boys	250	.53	66	.36
	Girls	175	.48	49	.37
	Total	425	.51	115	.36
Iowa Content Hist.	Boys	213	.38	54	.15
	Girls	118	.55	38	.47
	Total	331	.42	92	.21
Iowa Content Total	Boys	211	.47	54	.28
	Girls	117	.39	38	.41
	Total	328	.41	92	.23
Reg. American Hist.	Boys	240	.33	65	.21
	Girls	176	.45	49	.59
	Total	416	.38	114	.39
A. C. E. Total	Boys	254	.32	69	.19
	Girls	187	.37	50	.07
	Total	441	.34	119	.11
A. C. E. Opposites	Boys	259	.42		
	Girls	187	.26		
	Total	447	.32		
Regents Biology	Boys	230	.21	65	.30
	Girls	161	.38	48	.36
	Total	391	.31	113	.32
Regents Latin III	Boys	152	.30	37	.39
	Girls	125	.14	33	.55
	Total	277	.30	70	.42

psychology. For the total group, the highest coefficient is r.42 between college sociology (largely the introductory course) and Regents Latin III. For the girls, two relationships are over r.50 with this subject: Regents Latin III (r.55), and Regents American history (r.59). No relationships were established between this course and reading test material; but the author would expect as close relationships between such a test and sociology as were found with psychology grades, as above.

Summary for Social Science Prediction

1. Probably the most important conclusion regarding this field is that prediction therein is less successful than it is for either English or the languages. This is even more true for the individual courses than for average attainment in all social science classes taken during the first two years of college attendance.

2. The total Regents average in general best predicts success in average social sciences, although relationships with it are not high for this field of academic information. Regents American history and Latin III are also of some value in the prediction of success in social science.

3. For girls, the best measures of future success in social science are Regents average, Regents biology, and Regents American history. For boys, the best predictive device is Regents average and Iowa Content Examination. (See Chapter XII for a discussion of sex differences.)

4. The Regents average and Regents American history best predict college European history; Regents Latin III best predicts grades in college English history; and the college freshman orientation course in social science best foretells success in American history (a sophomore college course).

5. For those who had had high school training in the subject, the American Council Economics Test best predicts success in introductory economics; Regents economics stands second. For the total group including those having had no high school economics, the Regents average and the Nelson-Denny Reading Test rank high; while for the boys, Regents Latin III is best; and for the girls, the Iowa Content sub-test History gives the highest correlation coefficient. Advanced college economics is most closely related to introductory economics.

6. The total "academic" Regents average, the Nelson-Denny Reading Test, and the Iowa Content sub-test History give the best relationships with introductory psychology.

7. For the total group, no *r's* are obtained with sociology over .50. The most predictive measures are Regents Latin III for the total group, and, in addition, Regents American history for the girls.

V. PREDICTION OF SUCCESS AND FAILURE IN PHYSICAL SCIENCE

In general, the least predictable field is mathematics; second in difficulty of forecasting accomplishment is physical science. In spite of which dire statement, Regents Latin III correlates with average college physical science to the extent indicated by r.74 for the total group of students having had some physical science during the first two years of their college attendance.

For girls, total Regents average, Regents American history, and Regents biology are related to success and failure in the physical sciences as indicated by r.54, r.57, and r.52 respectively. Regents Latin III correlates r.51 with our criterion for boys. Except for rank in high school graduating class, all other *r's* are less than .50, the majority being less than .40.

Rank in graduating class, for students from four large high schools, is related to average college physical science to the degree of r.50.

The low *r's* obtained between the average grade in college science with grades in high school science and mathematics as well as with test scores in mathematics and science brought some surprise. Without investigating, one would not have guessed that Latin III and American history Regents would predict college science performance better than science and mathematics measures. Having such data at hand, however, one deduces that the sciences in college require the type of determination, motivation, persistence, and memory ability required in a study of Latin; also that the ability to read and retain facts, valuable in success in high school American history, is also needed in college science.

The Orientation Course in Physical Science

Our second criterion of general ability in physical science is success in an orientation course in this field given to freshmen during the first semester of their college attendance. Latin III Regents is the best indicator of success in this course, just as it indicated average success in general science. Regents American history stands second and is particularly good in predicting the science performance of girls; the total Regents average is third. This last is particularly good in estimating the success of boys. The total Iowa Content Examination is fourth high in its relation to our orientation course in physical sciences; the actual coefficient for the total group is r.42 and for the girls, r.55. The only other *r* above .40 is that with Regents biology for girls. The American Council Psychological Examination is definitely less related to college performance in this course, as well as to average work in the field, than all measures discussed above.

Physics

Three measures, of those investigated, are related to introductory college physics to the extent expressed by r.50. These are Regents trigonometry, chemistry, and physics. It is unfortunate that only a little over one-half of

TABLE XXI

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN AVERAGE PHYSICAL SCIENCE IN COLLEGE AND VARIOUS MEASURES

(Correlations listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Regents Latin III	216	.51	154	.47	370	.74
Total Regents Ave.*	223	.43	149	.63	372	.59
Rank in H. S. Grad. Class*	236	.48	155	.55	391	.50
Total Regents Ave.	388	.44	214	.54	602	.46
Regents Amer. Hist.	350	.39	206	.57	556	.46
Regents Chemistry	128	.43	45	.34	173	.41
Iowa Content Total	338	.35	139	.41	477	.37
Regents Physics	228	.38	70	.34	298	.36
Regents Biology	326	.24	195	.52	521	.35
Iowa Content English	343	.30	139	.29	482	.31
Iowa Content Science	341	.33	139	.17	480	.24
A. C. E. Total	414	.18	227	.25	641	.22
A. C. E. Opposites	420	.24	227	.18	647	.22
A. C. E. Completion	420	.17	227	.31	647	.20
A. C. E. Analogies	356	.19	144	.16	500	.18
Age at H. S. Grad.	376	−.15	211	−.17	587	−.17
Iowa Content Math.	341	.17	139	.15	480	.16
No. H. S. Units	428	.15	228	.16	656	.15
A. C. E. Arithmetic	420	.11	227	.25	647	.14
A. C. E. Art. Lang.	420	.07	227	.11	647	.09

* See footnote, Table VIII.

TABLE XXII

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN INTRODUCTORY COLLEGE PHYSICS AND VARIOUS MEASURES

(Correlations listed according to size)

	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Regents Trigonometry	50	.48	9		59	.58
Regents Chemistry	87	.55	10		97	.57
Regents Physics	109	.54	14	.62	123	.55
Total Regents Ave.	153	.42	30	.48	183	.40
Iowa Content Science	145	.41	20	.07	165	.38
Iowa Content Total	146	.38	20	.30	166	.37
Regents Int. Algebra	178	.37	32	.24	210	.34
Regents Latin III	99	.34	23	.20	122	.30
Regents Amer. Hist.	158	.23	30	.49	188	.28
Iowa Content Math.	146	.31	20	.08	166	.24
A. C. E. Total	176	.19	32	.03	208	.17
A. C. E. Arithmetic	180	.06	32	.22	212	.08

those who take introductory college physics have had either of these courses in high school. Of the remaining measures investigated, the total Regents average is the best predictor, but the *r* for the total group of boys and girls is only .40, for the boys r.42, for the girls r.48. The Content Examination is next high in closeness of relationship; the Psychological Examination being considerably lower.

Chemistry

The policy of the Chemistry Department at this University has changed within the past few years, so that data as collected for subjects of the five-year group are not applicable at this time. However, a few comparisons are of interest.

Regents chemistry has been related to introductory college chemistry prior and since the change of policy. The magnitude of the relationships are surprisingly similar. For the earlier group, the relationship between Regents chemistry and the two semesters of introductory college chemistry was r.47 PE .06. For the more recent classes, Regents chemistry and the first semester of introductory chemistry correlate as indicated by r.46 PE .05. Among the measures investigated for the earlier group, the Regents chemistry grade was the most closely related to college chemistry. Only about one-third to one-half of the freshman college chemistry class had had the subject in high school, which makes us fall back on *r's* of less than .40 for the prediction of success of the remaining students. For fifty-six students taking chemistry since the change of policy in that department, and having had both physics and chemistry in high school, the relationship between the average Regents mark for these two subjects and the first semester of introductory chemistry was r.64[21]. Such a predictive measure covers only a minority of the members of the introductory college chemistry class, and leaves predictors at a loss for the remaining students. The relationship r.64, however, is suggestive for those coming from high school with a science sequence.

Fifty of the 1931-32 entering freshman class completed the introductory course in chemistry at this University. All of these had had chemistry in high school and had taken the Columbia Research Bureau Chemistry Test[22] prior to their taking the course. The relationship between the test results and grades for the year's course was r.63 PE .06. There is a possibility that this relationship might have been higher if it had not been for the fact that those making the highest test scores were placed in a special section in which the amount of work was greater and the pace more rapid. The relationship between the grades in the first semester of this course and the Columbia Research Bureau Chemistry Test was r.32 for the fifty-five cases for whom this material is available. The relationship between the total course grades and the chemistry test is of the same magnitude as that between course grades and average Regents chemistry and physics marks, but definitely superior to any other single measure. This test because of its content can be administered only to those who have had secondary school chemistry; and is, therefore, limited in its predictive value.

---

[21] See Mills, H. C., "Articulation of High School and College," *The University of Buffalo Studies*, 1934, IX, pp. 240-241.

[22] Constructed by E. R. Jette, S. R. Powers, and Ben D. Wood. Published by the World Book Company, Yonkers-on-Hudson, N. Y.

Biology

In the variety of introductory biology courses offered, there is a scattering of correlation coefficients of the magnitude of r.40 or more and an occasional one of r.50. For the year course in botany, the best relationship was with Regents average, r.41 for the total group. However, for a semester course in this subject, a more popular course, a relationship or r.51 was obtained. Latin III Regents was next high (r.41). The sub-test Science of the Content Examination was related to this semester course to the magnitude of r.34.

The year course in zoology is related most highly (r.61 for 91 boys and r.55 for the total class of 99) to the Iowa Content sub-test Science. When this zoology course is condensed to a semester course, the highest relationship for the total group is r.35 with Regents biology. For the 47 girls who had taken the semester course, Regents biology produced r.51 with our criterion.

With the sophomore course in comparative anatomy, no relationship was obtained of a degree as high as r.30. That is, no correlation coefficient was high enough to indicate a relation sufficient to allow the prediction of individual success with even a small amount of accuracy.

Geology

The best relationship between geology and any measure studied is that with the total Regents average, the relationship being r.49 for the total group of 126 students who took the course during their freshman or sophomore year. Total Iowa Content scores correlated with geology grades for the thirty-one girls to the extent indicated by r.55; for the same group, the Regents average correlated r.57. The majority of students who take this course in college, however, are boys, for whom the highest r is .39 (between Regents average and geology). High school science courses are but very slightly related to this field.

Summary for Physical Science Prediction

1. The physical and social sciences are about equally difficult to predict. Both for the general average in this field, and for a general orientation course concerning itself with physical science, queerly enough, Regents Latin III is the best predictor. Also, rather surprisingly, Regents American history for girls stands high in its predictive value.

2. Except for those students who have had either Regents chemistry, physics, or trigonometry, it is impossible to predict individual performance in

college physics with much accuracy. For group prediction, the Regents average may be used with some success.

3. Except for those students who have had chemistry or physics in high school it is impossible to predict individual success in college chemistry. The combination of physics and chemistry Regents marks predict college performance in chemistry as well as does the Columbia Research Bureau Chemistry Test.

4. The Regents average surpasses other measures studied in the prediction of college botany; while the Iowa Content sub-test Science is first in a list of *r's* with college zoology.

5. The Regents average is also the best predictive device for college geology. However, the relationship is not very high for this subject.

CHAPTER IV

GENERALIZATIONS REGARDING PREDICTION AT THE UNIVERSITY OF BUFFALO WITH BROADER IMPLICATIONS

IN the previous chapters, data have been described showing relationships between various criteria of college success and an abundance of other measures. Our interpretations of these are purely practical. The present author is not interested in using those measures which are highly related to the various criteria of college success as indices of superiority, as means of tagging some individuals as "intelligent" and others as "stupid." She is likewise uninterested in using the relationships herein described as measures of overlap or indications of identical element content. Whether A causes B, or B causes A, or both are caused by C is again another story.

Our practical purpose is the identification of measures which will classify good college prospects before they actually enter its doors. We wish to refuse admission to the unlikely student and thus save him from the chagrin and loss of morale consequent to failure as well as to eliminate the waste of time of administrator and instructor related to the partial training, identification, and final expulsion of such a student. More especially, we wish to identify the promising student so that he may be particularly encouraged to continue his academic training into college and that he may be stimulated to attain the achievement of which he is capable.

It is hoped that our findings, such as they are, may be of value to those taking part in the counselling of high school students, in the directing of the good college prospect into academic activity and in the discouragement of unlikely students from entering institutions of higher education. Too, the administrators may use such data in their sectioning or other classification of students. Personnel officers, it is hoped, may find herein material by which to guide, aid, and stimulate their advisees.

The purpose of our endeavors, it is repeated, is mainly empirical, to select and guide, not to hypothesize or theorize. Specifically we have attempted to determine what are the indices of college success in general and what the measures that foretell high achievement in specific fields of academic attainment.

I. SUBJECTS, MEASURES, AND METHODS

One hundred and thirty-eight items of information were collected regarding each of 822 University of Buffalo students, these items of information being entered on Hollerith cards. Included among these data were: Regents or school grades for each "academic" subject carried during high school attendance and total average Regents grade, marks for each "academic" subject carried during the first two years of college and college average for these two years, scores for total and sub-tests of the American Council on Education Psychological Examination, total and sub-test scores for the Iowa Content Examination, sex, age at high school graduation, fifth of high school graduating class, and type of school from which the student was graduated. Relationships of item to item, in the form of zero-order correlation coefficients[1], have been calculated to determine predictive measures of college success in general and in specific academic fields and individual classes. Some further analysis in the form of percentage differences and multiple correlation coefficients have been included.

II. THE REGENTS AVERAGE

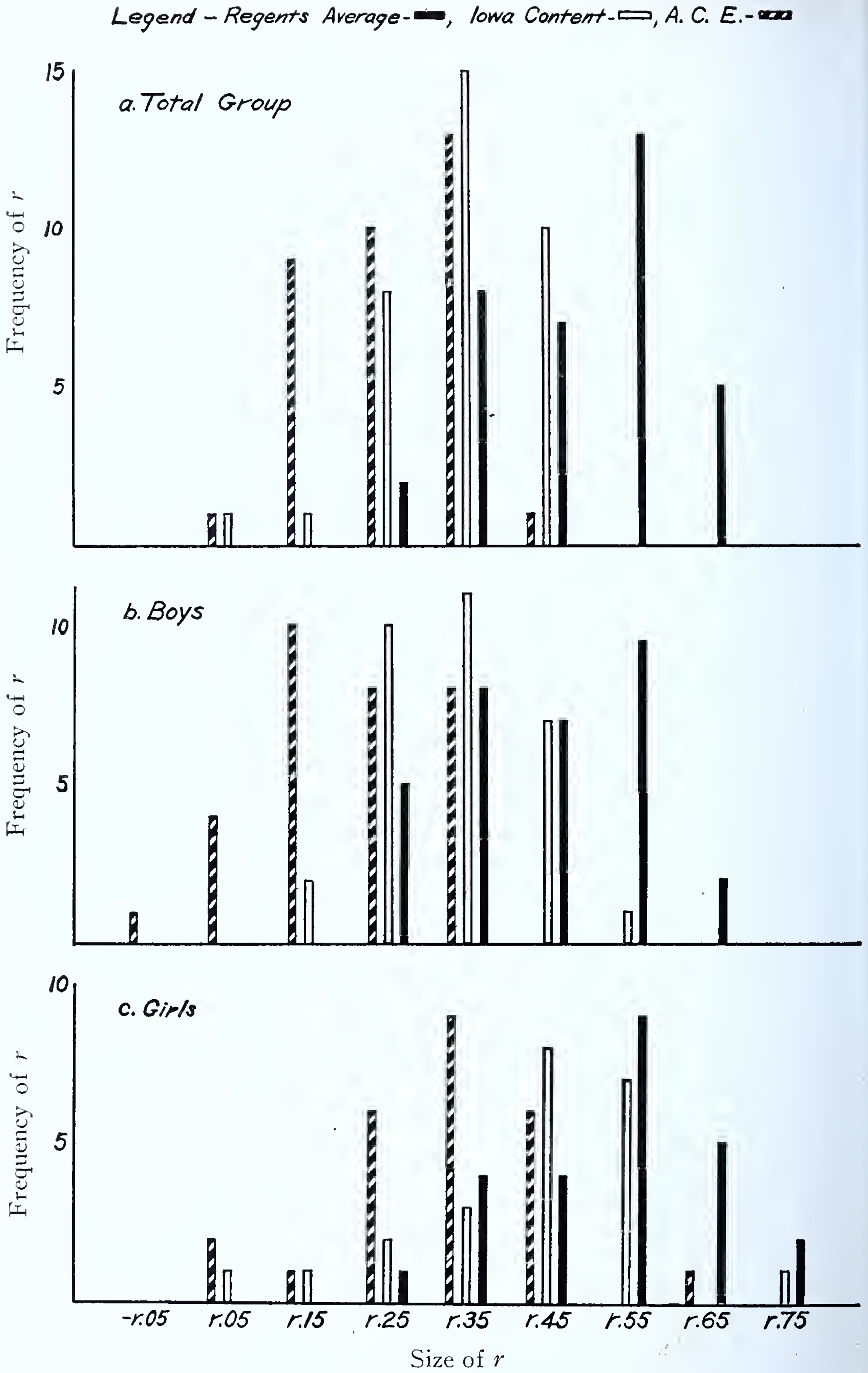
By and large, the total "academic" Regents average is the best single predictive device, of those measures studied, both for fields of knowledge and individual courses, as well as for a general college average. It seems to represent a medley of factors—ability, motivation, and others—so combined as to give the best measure, thus far obtained, of college aptitude. It is felt that this Regents average, which is a comparatively standardized and objective cumulative measure of secondary school success and attainment over a period of time, gives a picture of the individual's attack upon things academic, if not of his general reaction to any work situation. This average might be taken to indicate an individual's general seriousness of purpose, his academic motivation, mental level and strength, his adaptability to specific intellectual problems, jobs, and situations, together with many other qualities. It should be noted that all manner of "academic" attainment is included in this average, and that it is, in turn, more closely related to averages than to specific classes. Not only for our student body but for most other colleges as well[2], average secondary school attainment surpasses intelligence test performance in predictive value. Not so frequently, however, does one find secondary school performance surpassing a battery of placement tests such as is found in a content examination. All this, together with observation of students—a qualitative and comparatively unscientific procedure, to be sure—would indicate that the Regents average reflects a personality pattern. How closely it is related to that will-o-the-wisp, intelligence, or any other specific personality factor might well afford both interesting speculation and research.

Charts a, b, and c give a summary of the frequency of *r's* of various

---

[1] See footnote 8, Chapter II.

[2] See Chapter V.



(Grouped in ten point intervals; mid-point of intervals given.)

Figure I. The distribution of zero-order correlation coefficients showing relationship of Regents Average, Iowa High School Content Examination, and American Council on Education Psychological Examination for High School Seniors and College Freshmen, to various Freshman and Sophomore Averages and subjects.

magnitudes between the various college courses and fields[3] and (1) the total Regents average, (2) the total Iowa Content Examination for High School Seniors and College Freshmen, and (3) the American Council on Education Psychological Examination, for the boys, for the girls, and for both sexes combined. For the boys, the median *r* between all subjects and fields with the Regents average, Iowa Content, and Psychological Examination are r.44, r.33, and r.22 respectively; for the girls, in the same order, the relationships are r.54, r.44, and r.34; for the two sexes combined, again in the same order, the medians are r.50, r.34, and r.27.

The following further evidence for the general superiority of the Regents average should be noted. There is a close correspondence between the relative ease of subject prediction by the three measures described. Subjects poorly related to Regents average, on the whole, are even less related to the Iowa Content, and are practically unrelated to the Psychological Examination, while those for which comparatively high relationships are obtained with the Psychological Examination show somewhat higher relationships with the Iowa Content and definitely higher correspondence with the Regents average.

That the Iowa Content Examination is more closely related to success than the Psychological test is also evident from the above charts. That this is a general superiority is evident from Appendix I. Another conclusion drawn from this Appendix, however, comes as surprise; to wit, that the Opposites sub-test of the American Council Psychological Examination is superior in predictive value for most fields to the total Examination. The former is a seven minute test, while the latter requires one hour of testing time.

The author wishes again to point out the likelihood that undoubtedly both the American Council Psychological and the Iowa Content Examinations would have been more closely related to college averages and courses with a student body more variable in ability. The results obtained are interpreted, not as a reflection upon these tests, but rather as evidence of the highly predictive value of Regents Examination measures.

III. THE RELATIVE EASE OF PREDICTION OF THE VARIOUS SUBJECTS

In ease of prediction and in predictive value, the order of the fields of information is, in general, the languages, with possibly the classics at the very top, English, the social sciences, the physical sciences, and most difficult of all to forecast and least valuable as a predictor, mathematics. That this hierarchy would appear in other college populations is, though probable, not certain.

As stated, success in language is most easily predicted, as well as being itself an excellent predictor of *general* academic achievement. Not only are the highest relationships found in the section concerning language, but Regents Latin III, the only language for which relationships were established with fields other than its own and college average, was found to predict average college physical science and average college English better than any variable studied including both science and English test and course performance, or in fact any other measure investigated. It surpassed in magnitude of relation all measures except Regents trigonometry in the prediction of average college mathematical success. Although Regents Latin III does not surpass the Regents average in size of correlation with the social sciences, it is usually found among the top three or four most closely related measures for all college criteria.

---

[3] See Appendix, for lists of *r's* included in these charts.

One suggested explanation of the high relation of the languages to averages is that the languages form a dominating portion of both high school and college curricula, and, therefore, the averages of one level of education are more closely related to the languages of the other than to any other field of learning. It is further possible that tests constructed to predict college averages would be so made, because of this language dominance of the curriculum, that they predict languages especially well. That this is by no means the complete story is shown by the fact, described above, of the high predictive value of Latin III in quite unrelated fields.

Which of the personality factors, specifically required for success in Latin, are particularly valuable in academic fields other than the languages is not clear. The author would hazard the guess that among such factors are (1) willingness to do academic work, (2) sufficient motivation to do such study even when interest lags, (3) good retentiveness, and (4) general verbal facility.

It seems within the realm of possibility that success within a language is more completely a measure of academic perseverance or motivation, memory, and lingual facility, and more divorced from special interests, dislikes, or other factors making for a variable performance than are other fields of academic endeavor. That is to say, a language grade for an individual is more indicative of what he *can* and *will* do, than a grade in mathematics for which he may have a special dislike, or in American history concerning which he has much previous information. If tests can be constructed to measure "mental ability: speed and power", performance in a language may well include, in addition to these, general academic motivation.

It is unfortunate that lack of time prevented the calculation of coefficients of correlation between high school French and the various academic fields and courses. If the size of relation between this variable and the two-year college average is any indication of its general predictive value, high relationships may be anticipated between it and many college courses. The reason Regents Latin III was used rather than average high school French was that high school credit in the former was brought by about two-thirds of our freshmen while only about one-third had French in secondary school.

IV. PREDICTION OF SOPHOMORE COURSE PERFORMANCE

For sophomore college courses in practically every field, the best predictive measure is a freshman course grade in the same field. This is not surprising.

The more related in content and general situation the study of two subjects may be, the more likely that the results will be similar. Which of the two, similarity of situation or of content, is more important, is not clear. However, a combination is doubtless without peer in securing similarity of results[4] or in obtaining high relationships between variables.

V. PREDICTION VALUE OF INDIVIDUAL REGENTS GRADES

In addition to the Regents average, there is for practically every field and course studied at least one and sometimes several individual Regents marks, frequently including Latin III and high school subjects within the same field, which predict as well as and usually better than the best predicting standardized test or sub-test investigated in the present research. The comparatively high relationships between subjects within the same field but at different academic levels emphasize the point regarding similarity of content and its effect, improvement of relationship.

VI. AGE AT HIGH SCHOOL GRADUATION

Throughout this study, whenever correlation coefficients were calculated between age and either college average, field averages, or individual course grades, small negative *r's* of the order of r-.20 were obtained. The scatters of age at high school graduation versus grades always assume a characteristic shape: for the higher ages, the scatter of attainment is from extremely successful to complete failure. As one progresses across the table towards the younger students, the scatter narrows in such a way that the grade averages rise slightly. That is to say that the older groups showed a wider variability with lower medians than the younger student groups. Members of the latter group were neither as superior in ability nor yet as inferior, although on the average they were somewhat better than their older classmates.

VII. NUMBER OF HIGH SCHOOL UNITS CREDIT

The relationships of number of high school units credit at college entrance to total two-year college average and to the five field averages were calculated. Consistently there were low positive correlations of the level of r.20. The general form of the distributions was similar to those described for age, the complete range of attainment being for those with fifteen or sixteen units, this variability tapering off and the average attainment rising in value with increase of number of units.

VIII. SEX DIFFERENCES

The relationships for girls were in seventy-five to eighty per cent of the cases definitely higher than for boys. For about half of the remaining relationships there was no significant difference between the two sexes. For

---

[4] The reader is referred to E. L. Thorndike, *Psychology of Learning*, Chapter XII, 1912, 358-359, for a discussion of his theory of identical elements.

Regents chemistry, the Opposites sub-test of the American Council on Education Psychological Examination, Regents English grammar and the Mathematics sub-test of the Iowa Content Examination, the prediction coefficients were higher for boys. This factor probably accentuates the differences between the ease of predictability of the various academic fields, and should be kept in mind in comparing coefficients of correlation where the population is not identical.

The higher relationships produced by relating grades and scores for girls has been interpreted[5] to indicate that they work closer to their maximum output, and therefore, are less variable in their academic activity. An interesting investigation would be the determination of those factors of the culture pattern of boys which make for a comparatively variable academic motivation, or its converse, those factors within the culture pattern of girls which make for greater academic motivation.

Further comparison of the value of the various measures investigated in predicting the relative success of boys and girls in academic pursuits shows that, quite invariably, previous scholastic performance, where sustained interest and effort is necessary, is considerably more reliable as a predictor for girls; that tests which indicate verbal facility, such as the Opposites sub-test of the American Council on Education Psychological Examination, and tests which measure power and speed over a short period of time rather than enduring motivation are more valuable for boys.

IX. "OBJECTIVE" OR SHORT-ITEM PLACEMENT TESTS

An investigation of some of the more recent specific "objective" or short-item placement tests indicates that, on the whole, as single prediction devices, they are no better than the most closely related Regents subject or the total Regents average. That is to say, the Regents average predicts college English as well as does the Cooperative English Examination. The Columbia Research Bureau Chemistry Test ties with a combination of Regents chemistry and physics in predictive value for college chemistry. The high school French average or introductory college grades in this subject predict advanced college French better than does the Cooperative French test. There is one exception; the American Council Economics test does somewhat outstrip Regents economics in foretelling introductory college economics grades.

However, it should very definitely be noted that the *best* placement tests frequently tie with the better predictive Regents marks. For non-New York State secondary school student body, or for those New York State high school graduates for whom Regents grades are not available, such short-item examinations as the Cooperative English test, the Columbia Research Bureau Chemistry test, and the Nelson-Denny Reading test will have considerable value in the prediction of specific class or field success.

---

[5] Jones, E. S. The Grade-Test Correlation as an Index of Motivation. *School and Society,* October, 1932.

Our results, though meager in this respect, indicate that a combination of Regents grades and placement tests may well prove superior to that of either measure taken by itself in the prediction of class performance or general field averages.

X. SOPHOMORE TESTING PROGRAM RESULTS

The question arose: would the Regents average predict college success when measured by "objective" short-item examinations to the same degree as it does when such achievement is measured by average class grades. To answer this, the Regents average was related to both college averages and to scores for the total battery of the Sophomore Testing Program. For the limited group for whom these data were available, the general finding was that, regardless which measure of college success was used, the Regents measures equally well predict performance.

XI. COLLEGE ENGLISH PREDICTION

The best predictive measures of average college English and freshman work in this field are the total Regents average, total scores on the Cooperative English Examination, and Regents Latin III. For sophomore college English, the freshman course in the field and the total Cooperative English Test are most predictive. The Opposites sub-test of the American Council Psychological Examination is valuable in estimating the college English performance of boys; and the total Iowa Content Examination, for girls. Rank in graduating class for students coming from large high schools has predictive value for success and failure in college English.

XII. COLLEGE MATHEMATICS PREDICTION

No measure is reliable in the prediction of individual performance in college mathematics for our group of students. The best relationships obtained were with Regents trigonometry, Regents Latin III, and average Regents performance.

XIII. COLLEGE LANGUAGE PREDICTION

In predicting college language performance, the Regents average is generally superior both for language averages and specific classes in the various departments involved. Both school language averages and the higher Regents language examinations may be used with considerable reliability to foretell college language success. All measures described in this paragraph are superior to the Cooperative French test in such prediction. The relationships between the various parts and total scores of the American Council and Iowa Content Examinations, especially the total and Opposites sub-test of the first and the total and sub-test English of the latter, are higher than *r's* between these tests and other college courses; but are in nowise as good for the prediction of language success as are grades in languages previously studied, or the total Regents average.

XIV. COLLEGE SOCIAL SCIENCE PREDICTION

In general, the total Regents average stands highest in predictive value for college social science; Regents Latin III follows closely; and in a few instances, Regents American history is related as closely as either of the two previously mentioned measures. The total Iowa Content Examination and sub-tests History and English are of value in predicting performance in the social sciences for both boys and girls. As in all other fields, introductory college courses in the social sciences are more closely related to advanced courses in the same field than are other measures studied.

Specific placement or short-item tests have value in predicting special fields of performance, notably the American Council Economics Test for college economics and the Nelson-Denny Reading Test for success in psychology. In the absence of high school data, such tests may be used quite successfully to estimate future accomplishment of a student.

XV. COLLEGE PHYSICAL SCIENCE PREDICTION

Average college physical science is more closely related to Regents Latin III than to any other measure studied. As in other fields, the Regents average stands high in the prediction of average physical science together with forecasting specific physical science fields. High school chemistry and physics, each predicts not only its own college field but the other about equally well. The Science sub-test of the Iowa Content Examination is valuable in predicting college physical science in general and specific courses. Course placement tests also predict performance within the field tested.

XVI. POSSIBLE IMPROVEMENTS OF REGENTS AVERAGE PREDICTION

The most important single point made herein is the all inclusive high predictive value of the total "academic" Regents average. The author intends to eliminate from the Regents average, as studied above, all mathematics grades, except possibly trigonometry, together with other measures showing particularly low relationships with college average. It is hoped, in this manner, to further increase the predictive value of our most useful measure. It is planned to publish in this regard in the near future.

In the first chapter of our results, the point was made that dividing a total student body into more homogeneous groups (e. g. by sex or school) frequently netted better relationships within many of these smaller divisions. Further investigation of such more homogeneous grouping is planned; and further publication concerning consequent relationships, is intended.

A final labor intended to improve our predictions is the development of reading tests. There is some evidence that for prediction of the sciences at least, reading tests are quite superior.

CHAPTER V

A SURVEY OF THE LITERATURE ON COLLEGE PERFORMANCE PREDICTION

"PAST performance is the best index of ultimate success." (35) This best expresses the standpoint at which we have arrived as a result of our investigations. We have, therefore, proceeded to survey the findings of other investigators[1] for comparison with those from this institution. The following pages cover a review of some of the relationships reported between various criteria of college success[2] and those measures frequently used to predict these criteria: high school average, intelligence tests, a few of the placement and content examinations, and combinations of such measures. We have also surveyed some of the findings with regard to specific field and course performance.

I. HIGH SCHOOL AVERAGE

To test our thesis, we have gathered and listed relationships between college averages and high school general performance. For these, the median correlation coefficient between the two variables under consideration is in the neighborhood of r.56, with fifty per cent of the cases between r.50 and r.66. These *r's* cover various lengths of college attendance, a wide variety of curricula, and several measures of secondary school performance, i.e. rank in high school graduating class, weighted point hour ratio, general school average and weighted and unweighted Regents averages.

INVESTIGATOR	*r*	INSTITUTION	CRITERION
Abelson (1)	.49	New York Univ.	1st semester
Beatley (4)	men .65-.69	Harvard Univ.	1st year
Bolenbaugh & Proctor (5)	.28-.49	Univ. of Stanford	
Brammell (6)	.52	Univ. of Washington	1st year
Carson (10)	.78	Univ. of Pittsburgh	1st year
(used only Pittsburgh high school graduates where marking is standardized, and transmuted college grades.)			
Clark (11)	men .36-.52	Northwestern Univ.	1st semester
	women .42-.54	Northwestern Univ.	1st semester
	men .42-.49	Northwestern Univ.	2nd semester
	women .42-.49	Northwestern Univ.	2nd semester

---

[1] This survey does not claim to be inclusive. However, it is random in selection; and, it is hoped, therefore, representative.

[2] A wide variety of data have been used as criteria of academic success everything from one quarter or one semester of college work to the full four year term.

INVESTIGATOR		r	INSTITUTION	CRITERION
Clark (11)				
Rank in High School	men	.43-.52	Northwestern Univ.	1st semester
	women	.50-.57	Northwestern Univ.	1st semester
	men	.49-.51	Northwestern Univ.	2nd semester
	women	.53	Northwestern Univ.	2nd semester
Cocking, W. D. & Holy, T. C. (12)		.55	Univ. of Iowa	
Columbia University (13)		.29	Carnegie Inst.	
		.45	Columbia Univ.	
		.47	Cornell Univ.	
		.38	Ohio State Univ.	
Cowdrey	men	.45	Stanford Univ.	1st quarter
	women	.52	Stanford Univ.	1st quarter
Crawford (16)	men	.66	Yale University	1st year
Dempster (18)		.53	Johns Hopkins	
Douglass (19)		.56	Univ. of Oregon	1st 2 years
Edds (22)		.65	Milligan College	1st semester
Edgerton & Toops (24)		.55	Ohio State Univ.	
Ferguson (25)		.30	Univ. of Virginia	1st semester
(used great variety of secondary schools according to statement)				
Gilkey (31)		.50	N. Y. State T. C.	
Goldthorpe (32)				
Rank in High School		.62	Northwestern Univ.	1st year
Hartson (36)	men	.55	Oberlin	
	women	.46	Oberlin	
Hawkes (37)		.64	Gettysburg	1st semester
		.69	Vanderbilt	1st year
		.72-.77	Johns Hopkins	
Held (38)		.50	Univ. of Pittsburgh	
Johnston (41)		.63	Univ. of Minn.	1st year
Jones (42)		.50	Univ. of Pittsburgh	
Jordan (45)		.37-.59	Univ. of North Carolina	1st year
Lauer & Evans (48)		.49	Iowa	
Lincoln (50)		.69	Harvard Univ.	1st year
		.58	Harvard Univ.	2nd year
May (52)		.40	Syracuse Univ.	
McCrory (54)		.66	McCloud T. C.	
Neuberg (57)		.49	Wittenberg	
Newmark (58)		.51	Philadelphia Normal	
Odell (59)		.55	Univ. of Illinois	1st year
Odell (60)		.54	Univ. of Illinois	4 years
Pettit (62)		.63	Columbia	1st year
Pierson & Nettels (63)		.52	Los Angeles City Schools	1st year
Potthoff (65)		.60	Univ. of Chicago	
		.62	Univ. of Chicago	1st 2 years
Proctor & Cowdrey (66)		.41	Stanford Univ.	
		.52	Stanford Univ.	
Scates (72) (Chicago high school students)		.61	Chicago Univ.	1st year
(All high school students)		.56	Chicago Univ.	1st year
Schleier & Schreiber (73)		.69	West. Ill. T. C.	1st 2 terms
		.63	West. Ill. T. C.	1st 5 terms
Seashore (74)		.35	Columbia Univ.	
Smith (77)		.82	3 Southern Normals	1st semester
		.86	3 Southern Normals	1st year
		.83	3 Southern Normals	1st 2 years
Smith, F. O. (76)		.53	Univ. of Iowa	
Symonds (81)		.52	Hawaii	
Terman (82)		.53	Univ. of Iowa	
		.63	Columbia	
		.54	Arkansas	
		.54	Stanford	
		.38-.74	Texas	
		.58-.69	Harvard	

INVESTIGATOR	*r*	INSTITUTION	CRITERION
Underbrink (87)	.56	Univ. of Chicago	1st year
Wagner	.37-.83	Univ. of Buffalo	1st 2 years
	Median .64		
Wagner Rank in High School	.52-.67	Univ. of Buffalo	1st 2 years
Williamson (90)	.65	Minn. Private College	

II. INTELLIGENCE TESTS

More has been written about intelligence tests than concerning any other field of prediction. Each large university has its pet form, and has launched graduate students and members of the faculty into the competitive fray of investigating both home and foreign products of the post Army Alpha vintage. The following review is far from complete. It touches but some of the high spots.

The Army Alpha. Pintner (64) reviews the correlations obtained between this test and college averages. The range of coefficients is from r.15 to r.50 with a median of about r.37. No change of median or range resulted from the addition of *r's* secured by numerous authors not included in Pintner's list. (46) (2) (15)

Terman and Otis Intelligence Tests. These tests have not been used as widely as either the Army Alpha or those listed below. Relationships of r.26 (3), r.38 (59), r.42 (46), r.44 (71), r.46 (54), and r.50 (22) have been reported between college average and the Otis Self-Administering Examination; and r.31, r.39 (3) and r.47 (46) between college average and the Terman Intelligence Test.

The College Entrance Examination Board Aptitude Test. Correlation coefficients between the College Entrance Board Aptitude Test and college averages, as located within the literature range from r.41 to r.55 for large Eastern colleges, including Yale, Harvard, and Columbia. (7) (16) (50) (74)

The Ohio State University Test. Two relationships between college averages and the Ohio State University Test were located. Edgerton (23) at Ohio State obtained r.52 with junior college scholarship. Byrns (9) obtained r.43 with first year grade point average.

The American Council on Education Psychological Examination. Relationships between the American Council on Education Psychological Examination and college averages range from r.17 to r.81, the majority from r.40 to r.50. The following have reached this reviewer:

INVESTIGATOR	*r*	INSTITUTION	CRITERION
Douglass (19)	.45	Univ. of Oregon	1st 2 years
Drake (20)	.40-.51	Adelphi	1st semester
Fritz (27)	.53	Kansas T. C.	tl.coll.grades
Gerberlich (29) (¾ths of r's over .50)	.17-.81	Arkansas	
Kellogg (46)	.17	McGill Univ.	freshman av.
Schleier & Schreiber (73)	.60		

INVESTIGATOR	r	INSTITUTION	CRITERION
Thurstone (85)	.54	Univ. of Chicago	
	.40-.60	Various	various
Waits (88)	.49	Alabama Polyt.	

The Thorndike Intelligence Examination. A relatively large number of investigators report relationships between various measures of college success and the Thorndike Intelligence Examination. The median of those relationships is about r.41, with fifty per cent between r.38 and r.52. The following have reached this reviewer:

INVESTIGATOR	r	INSTITUTION	CRITERION
Bolenbaugh & Proctor (5)	.28-.45	Stanford Univ.	
Carson (10)	.42	Univ. of Pittsburgh	1st year
Colvin (14)	.37-.53	Brown Univ.	
Flemming (26)	.37		1st semester
Garrett (28) women	.41	Hunter	1st year
Grauer & Root (34)	.39	Univ. of Pittsburgh	
Held (38)	.39	Univ. of Pittsburgh	
Krieger (47)	.46-.54		
Lefever (49)	.29	Univ. of S. Calif.	1st year
Nelson (56)	.36	Univ. of Wisconsin	1st 2 years
Nelson (56)	.27	Univ. of S. Dakota	
	.38	Univ. of California	
	.41	Univ. of Chicago	
	.53	Stanford Univ.	
Rogers (69)	.61	Goucher	1st year
	.45	Goucher	2nd year
	.37	Goucher	3rd year
	.38	Goucher	4th year
Root (70)	.51	Univ. of Pittsburgh	1st year
Stillings (79)	.41	Univ. of Pittsburgh	1st semester
	.56	Univ. of Pittsburgh	2nd semester
Thorndike (85)	.65		
Wood (91)	.45-.67	Columbia Univ.	

Other Intelligence Test Surveys. Krieger (47) states that the average correlation between tests and college grades is between .43 and .48. Toops (86) surveyed colleges using tests during the year 1923-24 and found a median correlation coefficient of r.46. Jordan (45) reports averages of 50 *r's* for four intelligence tests with average school marks. The Army Alpha netted the lowest average, r.38; and the Miller, the highest, r.56. Hulse (39) surveys studies made to determine the value of intelligence tests in predicting college success. He states that coefficients ranged from r.24 to r.72 when the first year's average in college was used. Roberts reports a range from r.38 to r.53 between intelligence test scores and first year college grades. Douglass (19) gives an extensive table of such correlation coefficients. He says that the average coefficients are r.54 and r.44 respectively, and the medians r.55 and r.45, the former in each case being the correlation of college marks with high school marks, the latter between college marks and intelligence tests.

This review of reviews substantiates our own surveys: that the bulk of relationships is between r.40 and r.50. This is very definitely below that for the measures of high school average reviewed above.

III. CONTENT EXAMINATIONS AND BATTERIES OF PLACEMENT TESTS

There are relatively few reports regarding the general predictive value of either the Iowa Content Examination for High School Seniors and College Freshmen or the Sones-Harry High School Achievement Test. Stoddard (80) reports an r.38 at the State University of Iowa with first semester grades. Kellogg (46) reports an r.75 with freshman average scores at McGill University with a matriculation content examination. Held (38) who takes a composite score on a large battery of individual placement, intelligence, and content tests as a single predictive measure of success reports an r.61 with freshman grade average at the University of Pittsburgh.

Of those investigators who compare prediction criteria, the vast majority find that the high school record is more closely related to college success than any other *single* criterion which they have studied. Among these are Johnston at Minnesota (41), Proctor at Stanford (66), Brammell at the University of Washington (6), Carson at the University of Pittsburgh (10), Crawford at Yale (16), Lincoln at Harvard (50), Odell at Illinois (59), Messenger at Northwestern (55), Symonds at Hawaii (81), Douglass at Oregon (19) and others (22) (54) (63) (65) (73) (79) (84) (89) (90). The reader is referred to Douglass' monograph for further substantiation of this general thesis.

Exceptions to the general finding of the superiority of high school average as a single criterion of college success are those of MacPhail (51) at Brown who finds that the Brown University Test is better than the high school record which is in turn better than comprehensive examination or a content test. Wood (91) at Columbia finds that the Thorndike Intelligence Test is slightly better than the high school Regents average and significantly better than school averages. Rogers (69) at Goucher finds that the Thorndike Test is as good as the high school average or an entrance examination. Held (38) at Pittsburgh finds that a composite score on a battery of placement tests is better than a high school index.

IV. MULTIPLE CORRELATION COEFFICIENTS OR COMBINED RELATIONSHIPS

A combination of the better measures is usually found more predictive than the best single one. Quite frequently, however, the investigators state that the increase in predictive value does not warrant the added labor involved in the calculation of relationships and regression equations for such combinations. The following multiple coefficients (mathematical combinations) have come to our attention:

INVESTIGATOR	r	MEASURES	INSTITUTION	CRITERION
Bolenbaugh & Proctor (5)	.48-.54	Thorndike & HS Ave.	Stanford U.	
Byrns (9)	.63	HS Rank, OSU Intel. & HS Grade Pt. Ave.	U. of Wisc.	
Clark (11)	.63	HS Ave. & HS Rank	Northwest	1st yr.
Crawford (16)	.70	Entr. Exam., HS Ave. & Apt. Test	Yale	1st yr.
Crawford (17)	.74	C E E B Apt., HS Record, & Age	Yale	1st yr.
Douglass (19)	.64 (.50-.64)	HS Ave., %ile Intel., rank Industry rating	Oregon	1st 3 terms
Edds (22)	.71	Otis & HS Marks		1st yr.
	.74	Otis & Cross Eng.		1st yr.
	.70	HS Marks & Cross Eng.		1st yr.
	.81	HS Marks, Otis & Cross Eng.		1st yr.
Flemming (26)	.67	Thorndike, Colgate C-2 & Pressey X-O	Columbia	1st sem.
Hartson (36)	.75	HS Marks, Ohio St. Intel. Study perform. test	Oberlin	
Hawkes (37)	.66 (.58-.66)	HS Marks, Eng. & Sci.	Gettysburg Vanderbilt Johns Hopkins	1st sem.
Iffert (40)	.65	Best weighting placement test battery	U. Pittsburgh	General
Johnston (41)	.70	HS Ave. & Intel. Test	U. Minnesota	1st yr.
Jones, J. W. (43)	.65	HS Ave. Cross Eng. & Iowa Pl. Eng.		1st yr.
	.67	HS Ave. Cross Eng., Iowa Pl. Eng., and Detroit Intel.	Indiana St. T. C.	
	.67	HS Ave., Cross Eng., Iowa Pl. Eng., and Detroit Intel., Age		
Jordan (44)	.58	HS Ave. & Otis		
May (52)	.63	HS Ave. & ACE	Syracuse	
May (53)	.83	Miller Intel. & time spent studying	Syracuse	
McCrory (54)		Otis & HS marks	St. Cloud T. C.	1st yr.
Messenger (55)		IQ, Arith., Hist., Eng., & Read. tests & HS Ave.	Northern Ill. St. T. C.	1st quarter
Odell (59)	.58	HS Ave. & Otis	U. Illinois	1st yr.
Pierson & Nettels (63)	.65	HS Ave., Intel. Test, & Character Rating		1st yr.
Proctor & Cowdrey (66)	.58	HS Rec. & Thorndike	Stanford	
Stoddard (80)	.47	Thorndike, Iowa Content & Iowa Comprehension	U. Iowa	1st sem.
Symonds (81)	.59	HS Ave. & ACE	Hawaii U.	
	.57	Sch. Ave. and Intel.	Hawaii U.	
Wagner	.69	HS Regents Ave. & Iowa Content	U. Buffalo	1st 2 yrs.

The median multiple (combined) correlation coefficient is r.67 for the twenty-four authors we have listed. Fifty per cent are between r.60 and r.71. Two reports that seem interesting to the author are those of May at Syracuse and Hartson of Oberlin. The multiple coefficients obtained by these two investigators are among the highest three located in the literature which we surveyed. These are the only combinations which contain some measure of study performance; the first, the factor of time spent at studies, and the second, scores on a study performance test. Further investigation regarding the inclusion of study habits data is in order and may well be fruitful.

V. SPECIFIC FIELD PREDICTION

Specific field prediction is much less frequently investigated than college average. Occasionally, while predicting general college success, an investigator has, in addition, calculated a few relationships with individual class success or success within a particular department. To be certain, courses and classes vary widely from one university to another, and it is, therefore, quite conceivable that less has been published than has been investigated. That is to say that it may be felt that such relationships have value only for the specific department for which they are made; and, they have, therefore, not reached periodicals. This same reservation ought, of course, be made for general college prediction. And yet the accumulation of results gathered in many places may well indicate general tendencies and may aid in spotting individual institution peculiarities.

VI. PREDICTING COLLEGE ENGLISH SUCCESS

In our survey of relationships obtained with college English, we find, that, added to the fact that the specific criterion of college English success varies from one year to four years of college English, a very wide variety of measures have been used as predictive devices. For these measures and criteria, various as they are, we have computed a median relationship of about r.42 with a spread of the middle fifty per cent of coefficients between r.35 and r.51. As to the relative predictive power of the various measures used, little can be said from the relationships listed below as they are for very different types of student body. The data are given for whatever value they may have to future investigators and reviewers.

INVESTIGATOR	*r*	INSTITUTION	CRITERION	MEASURE
Abelson (1)	.50	New York U.	Freshman Eng.	3 yr. Regents Eng.
	.27	New York U.	Freshman Eng.	4 yr. Regents Eng.
Edds (22)	.50	Milligan	Freshman Eng.	H. S. Ave.
Garrett (28)	.57	Hunter Col.	College Eng.	CAVD
Geberlich (29)	.40-.77	Various	College Eng.	Placement tests
Gilkey (31)	.49	N.Y. State TC	4 yrs. college Eng.	4 yrs. Regents Eng.
Gowen & Gooch (33)	.28	U. of Maine	College Eng.	H. S. English
	.31	U. of Maine	College Eng.	Advanced French
Held (38)	.47	Pittsburgh	College Eng.	Composite of Pl. Tests
Jones, J. W. (43)	.50	Indiana U.	Ave. credit point	Iowa Placement & Cross Eng.
	.52	Indiana U.	Ave. in English	H. S. Eng. Ave.
	.51	Indiana U.	Ave. in English	H. S. Ave.
	.51	Indiana U.	Ave. in English	Detroit Intel. Test
Perrin (61)	.72	Texas	4 yrs. college Eng.	Special Intel. Test
Root (70)	.36	Pittsburgh	College Eng.	Thorndike Intel.
Stoddard (80)	.42	Iowa	College Eng.	Thorndike Intel.
	.39	Iowa	College Eng.	Thorndike Intel.
Wagner (See Chap. X)	.68-.09	U. Buffalo	Ave. Coll. Eng.	Various
Median .43				

INVESTIGATOR	r	INSTITUTION	CRITERION	MEASURE
Whitman (89)	.28		College Eng.	H. S. English
	.39		College Eng.	H. S. English
	.43		College Eng.	H. S. English
	.19		College Eng.	CEEB English
	.29		College Eng.	CEEB English
	.34		College Eng.	CEEB English

VII. PREDICTING COLLEGE MATHEMATICS

Fewer investigators have included relationships between college mathematics and predicting measures than have contributed to either English or the languages. For those who have, the median relationship between such criteria of college mathematics success and a variety of measures is r.38, with fifty per cent of the coefficients between r.33 and r.45. Other investigators, as well as the present writer, have found mathematics more difficult to predict than English or the Languages.

INVESTIGATOR	r	INSTITUTION	CRITERION	MEASURE
Abelson (1)	.66	New York Univ.	All Coll. Math.	Elem. Alg. Reg.
	.47			Int. Alg. Reg.
	.40			Pl. Geom. Reg.
	.16		Math. 1 & 2	Elem. Alg. Reg.
	.43			Int. Alg. Reg.
	.30			Pl. Geom. Reg.
Edds (22)	.48	Milligan College	Coll. Math.	H. S. Ave.
Garrett (28)	.33	Hunter	Coll. Math.	CAVD
Geberlich (29)	.59-.64	Various Colleges	Coll. Math.	Pl. Tests
Gilkey (31)	.34	N. Y. S. T. C.	All Coll. Math.	All Math. Reg.
Gowen & Gooch (33)	.41	Univ. of Maine	Coll. Algebra	H. S. Alg.
1913	.41			H. S. Geom.
to	.41			H. S. Elem. Fr.
1921	.34			H. S. Chem.
	.40		Coll. Adv. Geom.	H. S. Adv. Fr.
	.38			H. S. Alg.
	.38			H. S. Elem. Fr.
	.34			H. S. Geom.
	.31			H. S. Chem.
Held (38)	.49	Pittsburgh	Coll. Math.	Comp. Pl. Test
Perrin (61)	.80	Texas	Coll. Math.	Spec. Intell. Test
Root (70)	.89-.61	Pittsburgh	Coll. Math.	Thorndike Test
Whitman (89)	.37		Coll. Math.	H. S. Marks
	.45			
	.49			
	.25			
	.27			CEEB Math. Test
	.33			

VIII. PREDICTING COLLEGE LANGUAGES

The distribution of relationships between various criteria[3] of college language and a variety of measures is very similar to that for college English. The median coefficient is r.43 with fifty per cent of the relationships between r.36 and r.49. This does not completely agree with our data in that we found the languages definitely easier to predict than college English.

[3] The same reservations regarding the variety of measures of college success and of predicting devices are made for languages, mathematics, as were made for English.

INVESTIGATOR	r	INSTITUTION	CRITERION	MEASURE
Abelson (1)	.70	New York Univ.	College French	French Reg.
	.50		College Latin	Latin Reg.
	.40		Elem. French	H. S. Eng.
	.43			H. S. Algebra
	.14			H. S. Latin
	.41		Adv. French	Elem. French
	.39			H. S. Eng.
	.32			H. S. Latin
	.43		College German	Adv. French
	.39			H. S. Latin
	.37			Elem. French
Brigham (8)	.44	Princeton	French	CEEB Fr. Exam.
	.47			CEEB in Latin, English, French
	.53			CEEB in Latin, English, French, Art. Lang. and Gen. Intelligence Test
Edds (22)	.53	Michigan		H. S. Average
Garrett (28)	.28		Classics	CAVD
	.23		Mod. Languages	CAVD
Geberlich (29)	.12-.90	Various	Coll. Foreign Languages	Iowa Pl. Tests
Gilkey (31)	.39	N. Y. S. T. C.	Coll. Anc. Lang.	Reg. Anc. Lang.
	.32		Coll. Mod. Lang.	Reg. Mod. Lang.
Held (38)	.45	Pittsburgh	Foreign Lang.	Comp. Pl. Test
Perrin (61)	.79	Univ. of Texas	Romance Lang.	Spec. Intel. Test
Root (10)	.40-.45	Pittsburgh	Coll. French	Thorndike
	.50		Coll. German	Thorndike
	.47-.67		Coll. Spanish	Thorndike
Wagner	.63	Buffalo	Ave. Coll. Lang.	H. S. Reg. Ave.
	.59		Ave. Coll. Lang.	H. S. Reg. Ave.
	.66		Intro. German	H. S. Reg. Ave.
	.54		Intro. French	H. S. Reg. Ave.
	.59		Intro. Latin	H. S. Reg. Ave.
	.56		Adv. French	H. S. Reg. Ave.
	.56		Adv. German	H. S. Reg. Ave.
Whitman (89)	.33		College French	H. S. French
	.36		College French	H. S. French
	.39		College French	H. S. French
	.43		College French	CEEB French
	.45		College French	CEEB French
	.47		College French	CEEB French

IX. PREDICTING COLLEGE SOCIAL SCIENCE

Those relationships reported for the social sciences are almost all surprisingly high. The median coefficient is r.63 with fifty per cent of the relationships between r.42 and r.68. It is unfortunate that we have but seven authors contributing fourteen relationships. It would be very interesting to have further investigations with regard to the prediction of college social science. This writer did not find this field easier to predict than English and the languages, as is the seemingly general finding.

INVESTIGATOR	r	INSTITUTION	CRITERION	MEASURE
Eckert (21)	.73	Buffalo	Soc. Sci. Orient.	Soc. Sci. Reg. Ave.
	.67	Buffalo	Soc. Sci. Orient.	Iowa Content total
	.65	Buffalo	Soc. Sci. Orient.	Iowa Content Hist.
	.65	Buffalo	Soc. Sci. Orient.	H. S. Soc. Sci. Ave.
	.59	Buffalo	Soc. Sci. Orient.	N.-D. Reading
Garrett (28)	.33	Hunter	Soc. Sci.	CAVD
Gilkey (31)	.34	N. Y. St. T C	Coll. Soc. Sci.	Soc. Sci. Reg.
Held (38)	.56		Hist.	Hist.
Perrin (61)	.76	Texas	Coll. Hist.	Spec. Intel. Test
	.66	Texas	Educ.	Spec. Intel. Test
Root (70)	.43-.48	Pittsburgh	Coll. Hist.	Thorndike
	.69	Pittsburgh	Human Prog.	Thorndike
Whitman (89)	.31		Coll. Hist.	H. S. Hist.

X. PREDICTING COLLEGE PHYSICAL SCIENCE

For the eight investigators and twenty-one relationships that we have located in the literature, there is little agreement. Some seem to find the physical sciences comparatively easy to predict, others, distinctly difficult, with a modal relationship of about r.50. The median coefficient is r.47, with fifty per cent of the relationships between r.26 and r.62. Very definitely there is a great need for further investigation regarding physical as well as social science prediction.

INVESTIGATOR	r	INSTITUTION	CRITERION	MEASURE
Edds (22)	.63		Coll. Lab. Sci.	H. S. Ave.
Gilkey (31)	.15	N. Y. St. T C	Coll. Sci.	Reg. Sci.
Gowen & Gooch (33)	.19	Maine	Coll. Chem.	H. S. Chem.
1915-21	.28	Maine	Coll. Chem.	H. S. Elem. Fr.
	.26	Maine	Coll. Chem.	H. S. Adv. Fr.
	.23	Maine	Coll. Chem.	H. S. Latin
	.23	Maine	Coll. Chem.	H. S. Geom.
Held (38)	.52		Coll. Lab. Sci.	Comp. Placement test %ile
Perrin (61)	.78		Coll. Phys.	Spec. Intel. Test
	.78		Coll. Zool.	Spec. Intel. Test
	.72		Coll. Bot.	Spec. Intel. Test
	.69		Coll. Chem.	Spec. Intel. Test
	.65		Coll. Geol.	Spec. Intel. Test
Root (70)	.43		Coll. Chem.	Thorndike
	.50-.53		Coll. Biol.	Thorndike
	.50		Coll. Phys.	Thorndike
Stoddard (80)	.50		Coll. Chem.	Thorndike
	.27		Coll. Chem.	Thorndike
Whitman (89)	.43		Coll. Sci.	H. S. Sci.
	.41		Coll. Sci.	CEEB Sci.

XI. SUMMARY

A survey of the literature would indicate that generally (1) mathematics was most difficult to predict, (2) English and the languages run a close second, (3) and that the sciences are easiest to predict, the social sciences being easiest of all. This is not consistent with the findings of our investigation.

Such measures as we investigated showed the languages to be definitely easiest of prediction, English and the social sciences second, followed by the physical science fields, with mathematics the most difficult to foretell.

The disagreement between the literature and our findings may be explained in part by the different measures used; in part, possibly, by the high school background of the student body; and probably somewhat by the various emphases of the particular institution studied.

Survey of the literature substantiates our general finding that the secondary school average predicts average college performance better than "intelligence" tests. Batteries of placement of subject tests are also very good predictors.

BIBLIOGRAPHY

1. Abelson, H. H. High School Marks vs. Psychological Test Scores to Predict College Success. M. A. Thesis, Teachers College, Columbia University, 1925.
2. Anderson, J. R. and Spencer, L. T. Predictive Value of Yale Classification Tests. Sch. and Soc., 1926, 24, 305-312.
3. Bayne, T. L. and Anderson, O. C. Study of Prediction of College Success. Ph. D. Thesis (unpub.), Cornell University, Ithaca, N. Y.
4. Beatley, B. The Relative Standing of Students in Secondary School, on Comprehensive Entrance Examinations, and in College. Sch. Rev., 1922, 30, 141-147.
5. Bolenbaugh, L. and Proctor, W. M. Relation of Subjects Taken in High School to Success in College. J. Educ. Res., 1927, 15, 87-92.
6. Brammell, P. R. A Study of Entrance Requirements in the University of Washington, Ph. D. Thesis, 1930.
7. Brigham, C. C. Correlation of the Examinations of the College Entrance Examination Board with College Standing. J. Engineering Educ., 1925, 15, 653-689.
8. Brigham, C. C. Prognosis of College Work in French. Publication of American and Canadian Committee on Modern Languages.
9. Byrns, R. K. Scholastic Aptitude and Freshman Achievement. Sch. and Soc., 1932, 35, 713-718.
10. Carson, F. H. A Study of Some Factors Influencing the Academic Success of Freshmen Students During Their First Semester in the University of Pittsburgh. M. A. Thesis, 1928.
11. Clark, E. L. High School average vs. High School Class Rank as a Means of Predicting College Grades. Sch. and Soc., 1931, 34, 765-66.
12. Cocking, W. D. and Holy, T. C. Relation of Intelligence Scores to High School and University Marks. Educ. Res. Bull. Bureau of Educational Research, Ohio State University, College of Education, Columbus, Ohio, 1927, 6, 383-384.
13. Columbia University. Report on the Use of Intelligence Examinations in Columbia University. 1927, 27p.
14. Colvin, S. S. Psychological Tests at Brown University. Sch. and Soc., 1919, 10, 27-30.
15. Colvin, S. S. and MacPhail, A. H. The Value of Psychological Tests at Brown University. Sch. and Soc., 1922, 16, 113-122.
16. Crawford, A. B. Forecasting Freshman Achievement. Sch. and Soc., 1930, 31, 125-132.
17. Crawford, A. B. Some Criticisms of Current Practice in Educational Methods. Harvard Teachers Rec., 1933, 3, 67-81.

18. Dempster, R. N. Coördination of Preparatory Training to Work in College as Based on Students Records. M. A. Thesis, Johns Hopkins University, 1922.

19. Douglass, H. R. The Relation of High School Preparation and Certain Other Factors to Academic Success at the University of Oregon. University of Oregon Publication, 1931, 3, No. 1.

20. Drake, C. A.· A Study of an Interest Test and an Affectivity Test in Forecasting Freshman Success in College. Teachers College Contribution to Education, 1931, No. 504.

21. Eckert, R. E. Study of Factors Conditioning Success in a College Orientation Course. (unpub.) M. A. Thesis, University of Buffalo, 1931.

22. Edds, J. H., and McCall, W. M. Predicting the Scholastic Success of College Freshmen. J. Educ. Res., 1933, 27, 127-130.

23. Edgerton, H. A. Academic Prognosis in the University. Baltimore, Warwick and York, 1930.

24. Edgerton, H. A. and Toops, A. H. Academic Progress. Ohio State University Press, 1929.

25. Ferguson, Geo. O. Jr. Some Factors in Predicting Academic Success in the College of Arts and Sciences. Sec. Educ. in Virginia, No. 12.

26. Flemming, Edwin G. College Achievement, Intelligence, Personality, and Emotion. J. Appl. Psychol., 1932, 16, 668-674.

27. Fritz, R. A. Predicting College Marks and Teaching Success for Students in a Teachers College. Kansas State Teachers College.

28. Garrett, H. E. A Study of CAVD Intelligence Examination. J. Educ. Res., 1930, 21, 103-108.

29. Gerberlich, J. R. Validation of a State-Wide Educational Guidance Program for High School Seniors. Sch. and Soc., 1931, 34, 606-610.

30. Gerberlich, J. R. and Stoddard, G. D. Personnel Survey of 10,000 Iowa High School Seniors. Sch. and Soc., 1929, 30, 515-20.

31. Gilkey, R. The Relation of Success in Certain Subjects in High School to Success in the Same Subjects in College. Sch. Rev., 1929, 37, 576ff.

32. Goldthorpe, J. H. The Relative Rank in High School and in the First Two Years of the University. Sch. and Soc., 1929, 30, 130-134.

33. Gowen, J. W. and Gooch, M. The Mental Attainments of College Students in Relation to Previous Training. J. Educ. Psychol., 1925, 16, 547-568.

34. Grauer, D. and Root, W. T. The Thorndike Intelligence Tests and Academic Grades. J. Appl. Psychol., 1927, 11, 297-318.

35. Hartmann, Geo. W. The Next Step in Homogeneous Grouping. Educ. Meth., 1933, 13, 141-144.

36. Hartson, L. D. The Most Valid Combination of Twenty-three Tests for Predicting Freshman Scholarship at Oberlin College. Ohio College Association Bull., No. 58, 1928.

37. Hawkes, Lena J. Certain Relationships between Scholarship in High School and in College. Johns Hopkins University Press, 1931.

38. Held, O. C. Attempt to Predict Success of University Freshmen in their Adjustment to Scholastic Work. University of Pittsburgh, Ph. D. Thesis (unpub.), 1931.

39. Hulse, M. L. The Relation between Intelligence Test Ranks and Scholastic Grades. M. A. Thesis, School of Education, Cornell University, 1929.

40. Iffert, J. T. M. A. Thesis, University of Pittsburgh, 1929.

41. Johnston, J. B. Predicting Success or Failure in College at the Time of Entrance. Sch. and Soc., 1924, 19, 772-776; 20, 27-32.

42. Jones, W. B., and Iffert, R. E. Selection, Retention, Achievement of the Class of 1928 of the University of Pittsburgh. Div. Res. in Higher Educ., University of Pittsburgh, 1930.

43. Jones, J. W. Scholastic Progress and Entrance Requirements in a State Teachers College. Ph. D. Thesis, School of Education, Indiana University, 1929.

44. Jordan, A. M. The Validation of Intelligence Tests. J. Educ. Psychol., 1923, 14, 348-366 and 414-428.

45. Jordan, A. M. Student Mortality. Sch. and Soc., 1925, 22, 821-824.

46. Kellogg, C. E. Relative Values of Intelligence Tests and Matriculation Examinations as Means of Estimating Probable Success in College Sch. and Soc., 1929, 30, 893-896.

47. Krieger, Laura. Prediction of Success in Professional Courses for Teachers. Contribution to Education, Teachers College, 1930, No. 420.

48. Lauer, A. R., and Evans, J. E. The Relative Predictive Value of Different High School Subjects on College Grades. Sch. and Soc., 1930, 31, 159-160.

49. LeFever, D. W. The Prognostic Value of Certain Groupings of the Test Elements of the Thorndike Intelligence Examination. University of Southern California Press, 1930.

50. Lincoln, E. A. Relative Standing of Pupils in High School, in Early College, and on College Entrance Examinations, Sch. and Soc., 1917, 5, 417-420.

51. MacPhail, A. H. Intelligence of College Students. Baltimore, Warwick and York, 1924, pp. 176.

52. May, M. A. Predicting Academic Success, J. Educ. Psychol., 1923, 14, 429-440.

54. McCrory, J. R. A Study of the Relation between Ability and Achievement. Educ. Admin. and Superv., 12, 1926, 481-490.

55. Messenger, H. R. The Probability-Table, a Possible Means for the Early Elimination of Poor Students. N. Ill. St. T. C. Quart., 1930, 25, 1-84.

56. Nelson, M. J. The Thorndike Intelligence Examination for High School Graduates as a Criterion for Predicting College Success. M. A. Thesis (unpub.) University of Wisconsin.

57. Neuberg, M. The Relative Value of Several Means of Prognosticating Success in College. Ohio College Association Bulletin No. 60, 1930.

58. Newmark, David. A Study of a Class in the Philadelphia Normal School. Phila. (no publisher given), 1931, pp. 150.

59. Odell, C. W. Predicting the Scholastic Success of College Freshmen. Bureau of Educ. Res. Bull., 1927, No. 52, pp. 54.

60. Odell, C. W. Predicting the Scholastic Success of College Freshmen. University of Illinois Bull., 1930, 28.

61. Perrin, F. A. C. The Freshman Psychological Examination in the College of Arts and Sciences at the University of Texas. Univ. of Texas Bull., No. 2445, 1924.

62. Pettit, W. W. A Comparative Study of New York High School and Columbia College Grades. M. A. Thesis, Teachers College, Columbia University, 1912.

63. Pierson, C. D. and Nettels, C. H. A Study of High School Seniors to Determine Who Shall Be Recommended to College. Sch. and Soc., 1928, 28, 215-216.

64. Pintner, R. Intelligence Testing. Henry Holt, New York, 1931.

65. Potthoff, E. F. Predicting the Ultimate Failure of College Students on the Basis of Their First Quarter's Records, Sch. and Soc., 33, 1931, 203-204.

66. Proctor, W. M. The High School's Interest in Methods of Selecting Students for College Admission. Sch. and Soc., 22, 441-448.

67. Rivett, B. J. Marks of Students in High School and Higher Institutions. Sch. Rev., 1924, 32, 752-756.

68. Roberts, A. C. Studies in Matriculation Statistics, Intelligence Ratings, and Scholarship Records at the University of Washington. pp. 47.

69. Rogers, A. L. Mental Tests for the Selection of University Students. Brit. J. Psychol., 1925, 15, 405-415.

70. Root, W. T. The Freshman Thorndike College Entrance Tests, First Semester Grades, Binet Tests. J. Appl. Psychol., 1919, 7, 77-92.

71. Rosenow, Curt. Predicting Academic Achievement. Ped. Sem., 1925, 32, 628-636.

72. Scates, D. E. Selective Admission and Selective Retention of College Students at the University of Chicago. Ph. D., School of Education, Chicago University, 1926.

73. Schleier, L. M. and Schreiber, E. W. The Freshman Testing Program. Western Ill. State T. C. Quart., 1932, 12, pp. 68.
74. Seashore, C. E. Notes on Experience in the Use of Mental Tests in College. National Research Council, 1921, pp. 13. Washington, D. C.
75. Second Annual Report of the Commission on Scholastic Aptitude Tests of the C. E. E. B.
76. Smith, F. O. A Rational Basis for Determining Fitness for College Entrance. University of Iowa, 1912, pp. 99.
77. Smith, F. O. University of Iowa Studies in Education, New Series, No. 51.
78. Somers, G. H. Pedagogical Prognosis. Teachers College Contrib. to Educ., 1923, No. 140.
79. Stillings, E. C. Educational Guidance at the University of Pittsburgh. Some Factors Influencing Academic Success of Freshmen in the University. Div. of Res. in Higher Educ., University of Pittsburgh, 1927.
80. Stoddard, G. D. Iowa Placement Examinations, Univ. of Iowa Studies in Educ., 1925, 3, No. 2.
81. Symonds, P. C. The Significance of Intelligence Tests in the University of Hawaii. Sch. and Soc., 1924, 20, 601-606.
82. Terman, L. M. Intelligence Tests in Colleges and Universities. Sch. and Soc. 1921, 8, 481-494.
83. Thorndike, E. L. On the New Plan of Admitting Students at Columbia University. J. Educ. Res., 1921, 4, 95-101.
84. Thurber, C. H. Is Scholarship Ranking Useful for Prediction. Sch. and Soc., 1933, 37, 327-329.
85. Thurstone, L. L. Psychological Tests for College Freshmen. Educ. Rec., 1925, 6, 69-83; 6, 282-294.
86. Toops, H. A. The Status of University Intelligence Tests in 1923-24. J. Educ. Psychol., 1926, 17, 23-36.
87. Underbrink, H. E. Relation between High School Marks and Success in College. M. A. Thesis, School of Education, University of Chicago, 1929.
88. Waits, J. Virgil. The Differential Predictive Value of the Psychological Examination of the American Council on Education. J. Exper. Educ., 1933, 264-271.
89. Whitman, A. D. The Value of College Entrance Examination Board Examinations on Prediction of College Success. Bureau of Publications, Teachers College, Columbia University, 1926. pp. 27.
90. Williamson, E. G. An Analysis of Scholastic Aptitude of Freshmen in Some Private Colleges in Minnesota. Sch. and Soc., 1931, 34, 674-680.
91. Wood, Ben D. Measurement in Higher Education. Yonkers-on-Hudson, N. Y. World Book Co., 1923, Chapter 4, 63-91.

APPENDIX

Zero-Order Correlation Coefficients Between the Various Freshman and Sophomore Averages and Subjects and (a) High School Regents Average, (b) Iowa High School Content Examination, (c) American Council Psychological Examination (1) Total, and (2) Opposites Sub-Test.

VARIABLES	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Two-yr College Ave						
H S Reg Ave	392	.61	217	.73	609	.64
Iowa Con Exam	347	.48	140	.57	487	.49
A C E Total	417	.27	227	.38	644	.33
A C E Opposites	430	.42	229	.33	659	.38
College English Ave						
H S Reg Ave	390	.53	217	.65	607	.60
Iowa Con Exam	340	.46	141	.62	481	.50
A C E Total	416	.39	229	.27	645	.35
A C E Opposites	422	.51	230	.45	652	.49
College Math. Ave						
H S Reg Ave	262	.41	78	.41	340	.37
Iowa Con Exam	222	.35	50	.18	272	.34
A C E Total	261	.18	80	.21	341	.20
A C E Opposites	285	.11	81	.13	366	.11
College Language Ave						
H S Reg Ave	301	.52	211	.69	512	.59
Iowa Con. Exam.	252	.27	134	.47	386	.33
A C E Total	305	.16	220	.42	525	.27
A C E Opposites	320	.27	221	.43	541	.34
College Physical Science Ave						
H S Reg Ave	388	.44	214	.54	602	.46
Iowa Con Exam	338	.35	139	.41	477	.37
A C E Total	414	.18	227	.25	641	.22
A C E Opposites	420	.24	227	.18	647	.22
College Social Science Ave						
H S Reg Ave	347	.56	213	.58	560	.56
Iowa Con Exam	304	.47	137	.46	441	.47
A C E Total	369	.29	225	.37	594	.32
A C E Opposites	375	.37	226	.31	601	.36
Freshman English						
H S Reg Ave	388	.49	217	.63	605	.58
Iowa Con Exam	342	.45	141	.58	483	.47
A C E Total	417	.38	229	.48	646	.40
A C E Opposites	424	.44	230	.47	654	.49
Sophomore English						
H S Reg Ave	376	.42	212	.49	588	.48
Iowa Con Exam	325	.38	138	.47	463	.39
A C E Total	400	.28	224	.33	624	.28
A C E Opposites	404	.42	225	.30	629	.38
Freshman Mathematics						
H S Reg Ave	232	.39	65	.24	297	.36
Iowa Con Exam	191	.35	45	.28	236	.33
A C E Total	241	.18	71	.22	312	.19
A C E Opposites						

VARIABLES	BOYS		GIRLS		TOTAL	
	No.	r	No.	r	No.	r
Introductory French						
H S Reg Ave	54	.50	36	.55	90	.54
Iowa Con Exam	40	.28	24	.51	64	.40
A C E Total	51	.15	37	.17	88	.14
A C E Opposites	53	.44	37	.17	90	.30
Advanced College French Ave						
H S Reg Ave	176	.55	174	.56	350	.56
Iowa Con Exam	143	.24	114	.50	257	.33
A C E Total	178	.25	181	.37	359	.30
A C E Opposites						
Introductory German						
H S Reg Ave	49	.54	29	.73	78	.66
Iowa Con Exam	48	.13	16		64	.22
A C E Total	62	.35	31	.44	93	.39
A C E Opposites	65	.40	31	.42	96	.42
Advanced College German Ave						
H. S. Reg Ave	65	.41	23	.50	88	.43
Iowa Con Exam	63	.13	13		76	.12
A C E Total	82	.08	25	.29	107	.08
A C E Opposites						
College Greek Ave						
H S Reg Ave	5		31	.59	36	.60
Iowa Con Exam					20	.38
A C E Total	5		30	.49	35	.44
A C E Opposites	5		30	.27	35	.21
Freshman Latin						
H S Reg Ave	24	.41	73	.64	97	.59
Iowa Con Exam	11		17		28	.06
A C E Total	22		73	.26	95	.26
A C E Opposites	22		74	.37	96	.27
Introductory Spanish						
H S Reg Ave	10		31	.76	41	.67
Iowa Con Exam	13		23		36	.23
A C E Total	13		30	.45	43	.28
A C E Opposites						
Advanced College Spanish Ave						
H S Reg Ave	22		25		47	.60
Iowa Con Exam					36	.48
A C E Total	23		24		47	.32
A C E Opposites	23		24		47	.22
General Physical Science						
H S Reg Ave	216	.54	193	.32	409	.45
Iowa Con Exam	181	.37	122	.55	303	.42
A C E Total	229	.24	208	.31	437	.28
A C E Opposites	177	.35	198	.30	375	.34
Zoölogy (2 semesters)						
H S Reg Ave	97	.29	16		113	.35
Iowa Con Exam	73	.39	8		81	.35
A C E Total	99	.18	19		118	.23
A C E Opposites						
Botany (1 semester)						
H S Reg Ave	81	.38	51	.60	132	.51
Iowa Con Exam	80	.34	53	.53	133	.42
A C E Total	83	.06	56	.49	139	.32
A C E Opposites	85	.05	56	.36	141	.21

VARIABLES	BOYS No.	BOYS r	GIRLS No.	GIRLS r	TOTAL No.	TOTAL r
Zoölogy (1 semester)						
H S Reg Ave	77	.24	50	.40	127	.30
Iowa Con Exam	81	.30	46	.07	127	.21
A C E Total	74	—.11	56	.31	130	.10
A C E Opposites						
Comparative Anatomy of Vertebrates						
H S Reg Ave	94	.29	9		103	.29
Iowa Con Exam	87	.25	8		95	.30
A C E Total	94	.10	8		102	.14
A C E Opposites						
Inorganic Chemistry						
H S Reg Ave	229	.38	66	.37	295	
Iowa Con Exam	200	.37	41	.30	24[illegible]	
A C E Total	239	.08	70	.29		.12
A C E Opposites						
Organic Chemistry						
H S Reg Ave	149	.37	13		162	.36
Iowa Con Exam	131	.37	8		139	.36
A C E Total	153	.23	12		165	.24
A C E Opposites						
Geology						
H S Reg Ave	98	.39	28	.57	126	.49
Iowa Con Exam	104	.26	31	.53	135	.33
A C E Total	109	.17	30	.46	139	.21
A C E Opposites						
Introductory Physics						
H S Reg Ave	153	.42	30	.48	183	.41
Iowa Con Exam	146	.38	20	.30	166	.37
A C E Total	176	.19	32	.03	208	.17
A C E Opposites						
General Social Science						
H S Reg Ave	172	.44	185	.66	357	.59
Iowa Con Exam	127	.46	114	.49	241	.45
A C E Total	175	.31	198	.36	373	.36
A C E Opposites	177	.36	198	.30	375	.34
Government						
H S Reg Ave	49	.61	20		69	.58
Iowa Con Exam	47	.25	12		59	.26
A C E Total	51	.39	23		74	.35
A C E Opposites	51	.46	23		74	.35
European History						
H S Reg Ave	82	.34	157	.58	239	.54
Iowa Con Exam	66	.57	90	.46	156	.49
A C E Total	93	.30	163	.35	256	.32
A C E Opposites						
English History						
H S Reg Ave	91	.39	23		114	.40
Iowa Con Exam	79	.25	17		96	.19
A C E Total	92	.13	23		115	.11
A C E Opposites						
American History						
H S Reg Ave	35	.29	34	.55	69	.36
Iowa Con Exam	24	.44	24	.48	48	.38
A C E Total	39	.36	34	.41	73	.36
A C E Opposites	40		35	.24	75	.09

VARIABLES	BOYS No.	BOYS r	GIRLS No.	GIRLS r	TOTAL No.	TOTAL r
Introductory Economics						
H S Reg Ave	235	.25	91	.47	326	.31
Iowa Con Exam	206	.33	63	.57	369	.39
A C E Total	254	.25	97	.62	351	.33
A C E Opposites	256	.32	98	.40	354	.34
Advanced College Economics Ave						
H S Reg Ave	90	.52	15		105	.51
Iowa Con Exam	102	.26	16		118	.23
A C E Total	109	.22	19		128	.28
A C E Opposites						
Psychology College Ave						
H S Reg Ave	250	.53	175	.48	425	.51
Iowa Con Exam	211	.47	117	.39	328	.41
A C E Total	254	.32	187	.36	441	.34
A C E Opposites	259	.42	187	.26	447	.32
Sociology College Ave						
H S Reg Ave	66	.36	49	.37	115	.36
Iowa Con Exam	54	.28	38	.41	92	.23
A C E Total	69	.19	50	.07	119	.11
A C E Opposites						

VITA

MAZIE EARLE WAGNER *was born in Williamsville, N. Y. In 1925, she received her B.A. in the Honors Division from the University of Buffalo; was assistant in the Department of Psychology 1925-1926, and instructor in the Departments of Psychology and Sociology the year 1926-1927 at this same institution. She received her M.A. in psychology in 1927 from this University also. During the year 1927-1928, she attended the University of Chicago, studying psychology, and assisting Professor Ogburn as research fellow in sociology and as laboratory assistant in statistics. During 1928-1929, she was Boys' Club fellow at New York University. The years 1929-1931, Miss Wagner spent as statistician for Vocational Service for Juniors under the direction of Dr. Mary H. S. Hayes. During the years 1928-1931, she was in attendance at Columbia University, studying psychology. Since September 1931, Miss Wagner has been research associate on the Study of the Superior Student and member of the School of Education faculty at the University of Buffalo.*